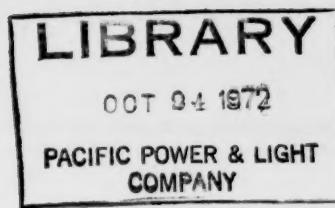


U.S. DEPARTMENT OF THE INTERIOR

OFFICE OF WATER RESOURCES RESEARCH
WATER RESOURCES SCIENTIFIC INFORMATION CENTER



SELECTED
WATER
RESOURCES
ABSTRACTS



VOLUME 5, NUMBER 18
SEPTEMBER 15, 1972

W72-10439 -- W72-11088

SELECTED WATER RESOURCES ABSTRACTS is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the National Technical Information Service (NTIS), U.S. Department of Commerce. NTIS was established September 2, 1970, as a new primary operating unit under the Assistant Secretary of Commerce for Science and Technology to improve public access to the many products and services of the Department. Information services for Federal scientific and technical report literature previously provided by the Clearinghouse for Federal Scientific and Technical Information are now provided by NTIS.

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SELECTED WATER RESOURCES ABSTRACTS

**A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior**



VOLUME 5, NUMBER 18
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Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1958.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus**. Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by co-ordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Rioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the

Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

KINETICS OF MASS TRANSFER AMONG SILICATES AND AQUEOUS SOLUTIONS, California Univ., Berkeley. Dept. of Geology and Geophysics. H. C. Helgeson. *Geochimica et Cosmochimica Acta*, Vol 35, No 2, p 421-469, February 1971. 23 fig, 4 tab, 35 ref. Northwestern Univ Grant SDC 17; NSF Grants GU2190, GE9758, GA11285.

Descriptors: *Mass transfer, *Silicates, *Aqueous solutions, *Kinetics, Theoretical analysis, Analytical techniques, Temperature, Diffusion, Chemical reactions, Equilibrium, Thermodynamics, Hydrolysis, Equations, Geochemistry. Identifiers: Empirical analysis.

Theoretical and empirical considerations suggest that the kinetics of mass transfer among aluminosilicates and aqueous solutions can be described by a simple parabolic rate law, which is consistent with diffusional mass transfer and applicable to incongruent as well as congruent reactions. The rate limiting step at both low and high temperatures consists of diffusion of material from the reactant mineral through a surface layer (or layers) of intermediate reaction products out into bulk solution, which means that precipitation of the reaction products can be described by reversible chemical reactions and equilibrium thermodynamics. Phase equilibria, mass transfer, and reaction paths predicted from theoretical equations and thermodynamic data are nearly identical to those observed experimentally. The thermodynamic calculations afford detailed interpretation of the results of experimental kinetic studies, evaluation of complicated chemical reactions in multicomponent systems and prediction of mass transfer in geochemical processes in terms of space/time coordinates. (Woodard-USGS) W72-10641

02. WATER CYCLE

2A. General

SOURCES OF STREAMFLOW IN A SMALL HIGH COUNTRY CATCHMENT IN CANTERBURY, NEW ZEALAND, Forest and Range Experiment Station, Rangiora (New Zealand). For primary bibliographic entry see Field 02E. W72-10473

LAND USE IN WAH WAH AND PINE VALLEYS, WESTERN UTAH, Brigham Young Univ., Provo, Utah. Dept. of Botany; and Brigham Young Univ., Provo, Utah. Dept. of Range Science; and Brigham Young Univ., Provo, Utah. Center for Environmental Studies. For primary bibliographic entry see Field 04A. W72-10515

THE RIVER BASIN MODEL: COMPUTER OUTPUT. Envirometrics, Inc., Washington, D.C. For primary bibliographic entry see Field 06A. W72-10574

MODELING GROUNDWATER INFILTRATION (MODELIROVANIYE FIL'TRATSII PODZEMNYKH VOD), For primary bibliographic entry see Field 02F. W72-10657

GEOPHYSICAL FORCES AND OCEANIC WATERS (GEOFIZICHESKIYE SILY I VODY OKEANA), L. V. Maksimov. Gidrometeoizdat, Leningrad, 1970. 448 p.

Descriptors: *Geophysics, *Oceanography, *Oceans, *Sea water, Ocean circulation, Ocean waves, Ocean currents, Tides, Tidal effects, Water level fluctuations, Sea level, Water temperature, Ice, Solar radiation, Climatology, Meteorology, Seasonal, Variability, Forecasting. Identifiers: *USSR, Nutation.

The effects of geophysical and cosmic forces on the world ocean are examined in connection with the origin and nature of seasonal and long-term variations of sea water. Investigations of the importance of deformation forces and of relatively unknown long-period, tide-producing forces for the ocean are based on recent data obtained by Soviet and foreign researchers. Topics include: (1) long-period, lunar-solar tides in the ocean; (2) concept of 'pole tide' in the ocean; (3) long-term variations in tide-producing forces on land; (4) near-pole solar phenomena in the ocean; and (5) deformation forces and long-range marine forecasting. (Josefson-USGS) W72-10662

INTERDISCIPLINARY APPROACH TO FLOOD PLAIN PROBLEMS, Tennessee Valley Authority, Knoxville. For primary bibliographic entry see Field 02E. W72-10718

CONCEPTUAL HYDROLOGIC MODELS FOR URBANIZING BASINS, Purdue Univ., Lafayette, Ind. School of Civil Engineering.

R. A. Rao, J. W. Deleur, and B. S. P. Sarma. *Journal of the Hydraulics Division, American Society of Civil Engineers*, Vol 98, No HY7, Paper 9024, p 1205-1220, July 1972. 6 fig, 3 tab, 25 ref, append.

Descriptors: *Models studies, *Urban hydrology, *Storm runoff, *Mathematical models, *Urbanization, Rainfall-runoff relationships, Unit hydrographs, Urban drainage, Meteorology, Urban runoff, Storm runoff.

After a preliminary analysis of urban rainfall-runoff relationships, the single linear reservoir and the Nash Model were selected for further study. Analysis of about 200 storms from watersheds with different degrees of development indicated that the parameters of these models varied not only with the urbanization factor (related to the ratio of the built-up area in a watershed to the total watershed area) but also with other physiographic and meteorological factors. Regression relationships were developed relating the parameters of the models and the more significant meteorological and physiographic factors, including the urbanization factor. These regression relationships were used to simulate the instantaneous unit hydrographs on a watershed for various urbanization factors. Changes in runoff from a watershed with increasing urbanization factors were then simulated for a variety of rainfall characteristics. (Knapp-USGS) W72-10723

MODEL TO PREDICT MEAN ANNUAL WATERSHED DISCHARGE, Federal Highway Administration, Washington, D.C.

S. I. Majtenyi. *Journal of the Hydraulics Division, American Society of Civil Engineers*, Vol 98, No HY7, Paper 9034, p 1171-1186, July 1972. 2 fig, 5 tab, 10 ref, append.

Descriptors: *Water yield, *Small watersheds, *Rainfall-runoff relationships, *Discharge (Water), *Drainage density, Drainage patterns (Geologic), Mapping, Terrain analysis, Aerial photography, Water balance, Temperature.

A method was developed for the estimation of long term discharge characteristics of small watersheds. Besides the annual precipitation and the annual mean temperature, other factors also influence the discharge. Two newly established watershed parameters were developed for improving the long term discharge prediction techniques. The first watershed parameter may be determined from a few years long discharge-precipitation-temperature record. The second watershed parameter is related to the drainage density, and reflects the soil texture. Long term discharge is higher from watersheds having high drainage densities, provided the other factors are identical. Evaluation of the drainage density from aerial photographs requires the application of a system of conventions, which are discussed in detail. (Knapp-USGS) W72-10724

ENERGY AND MASS TRANSFER THROUGH AN AIR-WATER INTERFACE, Stanford Univ., Calif. Dept. of Civil Engineering. P. A. Mangarella, A. J. Chambers, R. L. Street, and E. Y. Hsu.

Available from the National Technical Information Service, Springfield, Va., 22151, as PB-202 458, \$3.00 in paper copy, \$0.95 in microfiche. Technical Report No 134, May 1971. 175 p, 60 fig, 2 tab, 55 ref, 4 append. NSF Grant GA-1471.

Descriptors: *Air-water interfaces, *Energy transfer, *Mass transfer, *Model studies, Equations, Methodology, Analytical techniques, Meteorological data, Winds, Waves (Water), Turbulence, Laboratory tests, Temperature, Heat transfer, Boundary layers, Forecasting.

Energy and mass flux through an air-water interface was determined by applying conservation of energy and mass in the integral equation form to the flow over the waves. Normalized energy and mass transfer were expressed as Stanton numbers. Over wind waves the Stanton numbers were approximately twice the heat transfer Stanton numbers over a flat plate, all other things being equal. For spray, the mass transfer Stanton numbers were larger than those for the other wind wave cases. Energy and mass flux appeared to reduce when mechanically generated waves were present with wind waves. The interface temperature was determined by remote sensing using an infrared radiometer. The bulk-interface temperature difference was proportional to the measured total energy transfer through the interface. The flux results from data taken under the most favorable experimental conditions (wind waves, heated water) suggest that energy and mass transfer are governed by essentially similar processes. It is possible, therefore, for applications similar to these, to predict one flux (either energy or mass) on the basis of a computed value of the other. (Woodard-USGS) W72-10730

TREE RINGS, STREAM RUNOFF, AND PRECIPITATION IN CENTRAL NEW YORK-A REEVALUATION, Geological Survey, Arlington, Va.

R. L. Phipps. Prof. paper 800-B available from GPO, Washington, DC 20402 - Price \$2.25. In: *Geological Survey Research 1972, Chapter B: US Geological Survey Professional Paper 800-B*, p B259-B264, 1972. 1 fig, 4 tab, 8 ref.

Descriptors: *Dendrochronology, *Paleoclimatology, *Growth rates, *Runoff, *Precipitation (Atmospheric), Water balance, Forests, *New York. Identifiers: *Dendroclimatology.

Field 02—WATER CYCLE

Group 2A—General

Correspondence of years of extreme tree growth, as measured from increment cores of conifers in central New York, to years of extreme stream runoff and precipitation indicates that years of large amounts of stream runoff, years of large amounts of precipitation, and years of small amounts of precipitation can be determined from tree rings of certain trees growing in certain habitats. (Knapp-USGS)
W72-10740

DEPTH METER ATTACHMENT FOR UNDERWATER PRESSURE GAUGES,
Pittman Products, Inc., Huntington Park, Calif.
(assignee).
S. G. Lecocq.

U. S. Patent No. 3,528,290, 2 p. 3 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 878, No. 3, p. 591, September 15, 1970.

Descriptors: *Patents, Instrumentation, Measurement, *Meters, *Pressure measuring instruments, Water level recorders, Depth, Gages.
Identifiers: Diver's equipment, *Depth meters.

A depth meter attachment is provided for mounting on an underwater diving pressure gauge. The attachment consists of an adaptor bezel which fits on the body of the pressure gauge. The bezel carries a ring and moving fluid type depth gauge. The depth gauge dial plate has a central opening through which the pressure gauge dial plate and indicator are visible so both dial plates are visible at the same time. (Sinha-OEIS)
W72-10771

SOME RECOMMENDATIONS FOR THE OPERATION OF REPRESENTATIVE AND EXPERIMENTAL BASINS AND THE ANALYSIS OF DATA.

World Meteorological Organization Reports on WMO/IHD Projects, Report No 15, Contribution to International Hydrological Decade (IHD), 1971. 33 p. 3 fig.

Descriptors: Demonstration watersheds, *Rainfall-runoff relationships, *Small watersheds, *Unit hydrograph analysis, Computer programs, Time lag, Time of concentration, Peak discharge, International Hydrological Decade.
Identifiers: *Representative watersheds.

In the use of a small catchment area as a representative basin, it is usually essential to determine the proportion of the flow which is in the form of surface runoff. For this purpose, methods such as those using unit hydrographs can be applied. A simplified method is suggested in which the separation of surface runoff and intermediate flow is represented on the original hydrograph by a straight line drawn between two points which are precisely defined. It is thus possible to determine precisely the time of peak flow and the duration of surface runoff, and consequently the maximum runoff and the mean discharge. The time lag between a rainstorm and the resulting flood peak is also determined. All these operations can be carried out by computer; an operational program in FORTRAN IV is given. Infiltration is determined using observational data on runoff and the water balance. Measurements may also include use of artificial sprinkling by rainfall simulators. Infiltration may be determined from experimental relationships for the transformation into streamflow of rain or snowmelt, or by empirical relationships involving the physical properties of soils. (Knapp-USGS)
W72-10902

ROLE OF SUBSURFACE FLOW IN GENERATING SURFACE RUNOFF: I. BASE FLOW CONTRIBUTIONS TO CHANNEL FLOW,
Thomas J. Watson Research Center, Yorktown Heights, N.Y.
R. A. Freeze.

Water Resources Research, Vol 8, No 3, p 609-623, June 1972. 8 fig, 2 tab, 19 ref. OWRR C-3144 (3694) (1).

Descriptors: *Base flow, *Surface-groundwater relationships, *Mathematical models, *Numerical analysis, Unsteady flow, Saturated flow, Unsaturated flow, Water balance, Surface waters, Groundwater, Groundwater movement, Infiltration, Rainfall-runoff relationships, Hydrograph analysis.

The mechanism of base flow generation and the nature of watershed response in base flow dominant streams are examined with a deterministic mathematical model that couples three-dimensional, transient, saturated-unsaturated subsurface flow and one-dimensional, gradually varied, unsteady channel flow. The channel flow model uses the single step Lax-Wendroff explicit technique to solve numerically the full shallow water equations. The subsurface flow model uses the line successive overrelaxation technique to solve numerically the Jacob-Richards diffusion equation. The results of the simulations on a hypothetical basin suggest a wide variability in watershed response under the influence of variations in rainfall properties, antecedent moisture conditions, and saturated and unsaturated subsurface hydrogeologic properties. This evidence of a wide range of watershed response functions leads to skepticism toward black box rainfall-runoff correlations, the concept of basin linearity, and the rationality of hydrograph separation. (Knapp-USGS)
W72-10905

WATER-RESOURCES INVESTIGATION USING ANALOG MODEL TECHNIQUES IN THE SAUS-NEWHALL AREA, LOS ANGELES COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, Calif.

For primary bibliographic entry see Field 02F.
W72-10912

WATER MOVEMENT IN LAYERED SOILS: A SIMULATION MODEL,
Agricultural Univ., Wageningen (Netherlands).
Dept. of Theor. Prod. Ecol.

For primary bibliographic entry see Field 02G.
W72-11029

2B. Precipitation

PRECIPITATION MEASUREMENT IN NEW ZEALAND REPRESENTATIVE AND EXPERIMENTAL BASINS,
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
W. B. Morrissey.

Journal of Hydrology (New Zealand), Vol 6, No 1, p 20-32, 1967. 1 tab, 4 ref.

Descriptors: *Precipitation gages, *Rain gages, *Data collections, Equipment, Instrumentation, Automation, Demonstration watersheds, International hydrological decade.
Identifiers: *New Zealand, *Representative watersheds.

Manual and automatic instrumentation is used for precipitation measurement on experimental and representative basins in New Zealand. The performances of a sample of available recording precipitation gages are compared and the optimum resolution of time and rainfall for the different purposes and climatic situations discussed. The manual sampling of precipitation is carried out by means of the standard British gages of 5-inch diameter orifice and of 8-, 27-, and 50-inch capacity. The operations of the simpler precipitation recorders are governed by four main principles - the tipping bucket, the float and siphon, the float and storage tank, and the storage tank weighing. (Knapp-USGS)

W72-10474

PERSISTENCE OF DAILY RAINFALL AT SOME NEW ZEALAND STATIONS,
New Zealand Meteorological Service, Wellington.
J. Finkelstein.

Journal of Hydrology (New Zealand), Vol 6, No 1, p 33-45, 1967. 5 tab, 9 ref.

Descriptors: *Rainfall, *Frequency analysis, *Markov processes, Statistics, Climatology, Meteorology, Erosion, Statistical models, Probability, Variability.
Identifiers: *Rainfall persistence, *New Zealand.

The frequency of runs of various types of rainfall days was determined at Wellington, Milford Sound, Alexandra, and Invercargill, New Zealand. In all seven sets of runs examined the results indicated that the probability of the event occurring increased appreciably after it had occurred once. The frequencies all fitted the simple Markov chain model reasonably well. The highest persistence found was for days with at least 0.01 in. of rain at Milford Sound in winter, and the lowest for days with at least 0.01 in. of rain at Alexandra in spring and summer. All the sets of runs showed a maximum of persistence in autumn or winter. The minimum in spring at some stations was associated with the generally rapid movement of weather systems in spring in the New Zealand area. (Knapp-USGS)
W72-10475

A STUDY OF DROPLET SPECTRA IN FOGS,
Advanced Technology Labs. Inc., Jericho, N.Y.
P. Baronti, and S. Elzweig.

Available from the National Technical Information Service, Springfield, Va., 22151 as AD-736 054, \$3.00 in paper copy, \$0.95 in microfiche. Technical Report ATL TR-161, March 1971. 37 p. 16 fig, 9 ref. USAF Contract F44620-70-C-0007.

Descriptors: *Fog, *Supersaturation, *Drops (Fluids), *Distribution patterns, *Model studies, Condensation, Mathematical models, Equations, Air masses, Turbulence, Diffusion, Heat transfer.
Identifiers: *Fog dynamics.

A dynamical fog model, which explains fog maintenance, is utilized as a basis for the description of the droplet distributions within fog layers. The possible phenomena leading to the observed droplet size distributions are discussed and relationships between these distributions and expected conditions of supersaturation and turbulence in a stationary fog are developed. It is postulated that condensation nuclei enter the fog layer from above and are activated by the prevailing conditions of supersaturation existing within the layer. The droplets grow in the supersaturated environment and fall under the influence of gravity. The description of such a system in which particles of all sizes are present requires a statistical formulation, as is provided by the spray equation. Solutions of the spray equation are unrealistic when droplet diffusion is disregarded. A spray equation which incorporates droplet diffusion is developed together with the requisite boundary and initial conditions. The turbulence is taken to be fully developed within the fog with the exception of thin layers near the ground and fog top where it rapidly decays. Only by coupling the present analysis with a radiation analysis will it be possible to determine the actual distribution of supersaturation and actual droplet size spectra. Nevertheless, the present results indicate many important features of the phenomena, and provide quantitative estimates of droplet size and number density which correlate with observations. (Woodard-USGS)
W72-10731

HURRICANE CAMILLE -- EFFECT ON STAGES IN ROSS BARNETT RESERVOIR, MISSISSIPPI,
Geological Survey, Jackson, Miss.
For primary bibliographic entry see Field 02H.
W72-10738

WATER CYCLE—Field 02

Snow, Ice, and Frost—Group 2C

FOG DROP MEASUREMENT AT BARROW, ALASKA,
Cold Regions Research and Engineering Lab., Hanover, N.H.
M. Kumai, and R. F. Gienna.

Army Cold Regions Research and Engineering Laboratory Special Report 166, March 1972, 17 p., 4 fig., 3 tab., 9 ref. DA Project IT061102 B52A.

Descriptors: *Fog, *Alaska, *Instrumentation, *Particle size, *Sampling, Meteorology, Opacity, Optical properties.
Identifiers: Barrow (Alaska).

Arctic fog droplets were sampled on chloride-sensitive gelatin-coated glass slides at Point Barrow, Alaska, in the summer of 1971. About 20,000 fog drop radii were measured. The results of analysis of the concentration and the size distribution of fog drops are presented in the form of tables and photomicrographs. The concentration and the size distribution changed rapidly with time and space; the drop radii ranged widely between 3.3 and 65 microns; the mean radius was 10 microns; the maximum concentration was 24 drops/cc and the liquid water content was 0.09 g/cu m at a visibility of 250 m. The attenuation by fog was calculated at wavelengths of 0.571 and 1.06 microns for the observed size distributions and concentrations of fog drops. (Knapp-USGS)
W72-10894

AIR-SEA INTERACTION IN THE TROPICAL PACIFIC OCEAN,
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
L. J. Allison, J. Steranka, R. J. Holub, J. Hansen, and F. A. Godshall.

Available from NTIS, Springfield, Va 22151 as NASA TN D-6684 Price \$3.00 paper copy; \$0.95 microfiche. National Aeronautics and Space Administration Technical Note NASA TN D-6684, May 1972, 84 p., 22 fig., 13 tab., 61 ref., 4 append.

Descriptors: *Air-water interfaces, *Temperature, *Correlation analysis, *Tropical regions, *Pacific Ocean, Meteorological data, Air temperature, Water temperature, Analytical techniques, Anticyclones, Islands, Rainfall, Reviews.
Identifiers: Air-sea interaction, Sea surface temperature.

Sea surface temperature variations in the California and Peru Currents from 1949 to 1970 were traced from the west coasts of North and South America, respectively, to the central tropical Pacific Ocean by means of a newly produced atlas of SST anomalies. The SST anomalies have a good degree of correlation both positive and negative with the following monthly geophysical parameters: (1) satellite-derived cloudiness, (2) strength of the North and South Pacific semipermanent anticyclones, (3) tropical Pacific island rainfall, and (4) Darwin surface pressure. Several strong direct local and crossequatorial relationships were noted. In particular, the high degree of correlation between the tropical island rainfall and the SST anomalies ($r = +0.93$) permitted the derivation of SST's for the tropical Pacific back to 1905. The close occurrence of cold tropical SST and North Pacific 700-mb positive height anomalies with central United States drought conditions was noted. (Woodard-USGS)
W72-10913

GROWING SEASONS AND THE CLIMATIC MOISTURE INDEX,
Department of Agriculture, Ottawa (Ontario). Plant Research Inst.
For primary bibliographic entry see Field 03F.
W72-11025

2C. Snow, Ice, and Frost

FACTORS INFLUENCING DEEP ICE TEMPERATURES,
Swiss Federal Inst. for Snow and Avalanche Research, Davos-Weisfluhjoch.

K. Philibert.
Nature Physical Science, Vol 237, No 72, p 44-45, May 15, 1972. 1 fig., 13 ref.

Descriptors: *Glaciers, *Ice, *Heat flow, *Movement, Heat transfer, Glaciology, Regimen.
Identifiers: Greenland.

It is possible to simulate the real temperature profile of an ice cap by starting from the universal heat conduction theory and introducing four correction functions to take into account four additional factors influencing the temperature profile. By this procedure the temperature profile of Station Jarl Josef in Central Greenland was calculated and the results are compared with the values obtained by deep drilling. (Knapp-USGS)
W72-10648

INFILTRATION RATE AS AFFECTED BY SOIL FREEZING UNDER THREE COVER TYPES,
Forest Service (USDA), La Crosse, Wis. Watershed Lab.
For primary bibliographic entry see Field 02G.
W72-10708

THE EFFECTS OF SUSPENDED SILTS AND CLAYS ON SELF-PURIFICATION IN NATURAL WATERS: PROTEIN ADSORPTION,
Alaska Univ., College. Inst. of Water Resources.
For primary bibliographic entry see Field 05C.
W72-10808

INVESTIGATION OF THE BOUGUER-LAMBERT FORMULA FOR THE PENETRATION OF SOLAR RADIATION INTO ICE,
Kazakhskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Alma-Ata (USSR).
S. A. Shishokin.
Soviet Hydrology: Selected Papers, No 3, p 287-295, 1969. 5 fig., 3 tab., 4 ref. Trans. from Trudy Kaznigmii, no 32, 1969, p 139-148.

Descriptors: *Solar radiation, *Ice, Absorption, Mathematical models.

Identifiers: Bouguer Lambert formula, Transparency, Extinction coefficient, Intensity, Penetration.

Extensive data have been accumulated on the penetration of solar radiation into ice. The extinction coefficient determined by the Bouguer-Lambert formula is ordinarily used as the main characteristic of the radiational properties of ice, when the radiation intensity at certain depths is known. There is no consensus regarding the constancy of the light extinction coefficient in ice. Yet, experimental data were always analyzed by Bouguer Lambert formula. To determine whether this formula can be used, investigations were performed in the upper pool of the Krasnoyarsk hydroelectric station in March-April 1964. The experiments were made with three ice samples, snow ice, opaque slush ice and transparent ice. Penetration of solar radiation depends on solar height, type of radiation, amount and form of clouds, the thickness of structure, degree of decay of ice and the presence of snow. The results of experiments indicate that the penetration of solar radiation into ice follows a more complex pattern than light propagation in homogeneous turbid media. The probable reason for this is the crystalline structure of ice. (Upadhyaya-Vanderbilt)
W72-10823

GUIDE TO THE DESCRIPTION OF TILL,
Geological Survey of Canada, Ottawa (Ontario).
For primary bibliographic entry see Field 02G.

W72-10907

CHEMICAL INDICATORS OF ARCTIC BIOLOGICAL AND ENVIRONMENTAL ACTIVITIES,
Cold Regions Research and Engineering Lab., Hanover, N.H.

For primary bibliographic entry see Field 02I.
W72-10908

PRELIMINARY INVESTIGATIONS OF PETROLEUM SPILLAGE, HAINES-FAIRBANKS MILITARY PIPELINE, ALASKA,
Cold Regions Research and Engineering Lab., Hanover, N.H. Earth Sciences Div.
For primary bibliographic entry see Field 05C.
W72-10909

ANALYSIS OF THE MAJOR CATIONIC CONSTITUENTS OF THE 1964 TO 1969 SNOW ACCUMULATIONS AT DYE SITES 2 AND 3, GREENLAND,
Cold Regions Research and Engineering Lab., Hanover, N.H.
For primary bibliographic entry see Field 02K.
W72-10910

SOILS OF THE CARIBOU-POKER CREEKS RESEARCH WATERSHED, INTERIOR ALASKA,
Soil Conservation Service, Palmer, Alaska.
For primary bibliographic entry see Field 02G.
W72-10911

GRADIENTS OF PAST AND PRESENT OUTLET GLACIERS,
Geological Survey of Canada, Ottawa (Ontario).
J. T. Buckley.

Available from Geol. Survey of Canada, 601 Booth St., Ottawa, Price \$1.50. Canada Geological Survey Paper 69-29, 1929. 13 p., 5 fig., 2 tab., 16 ref.

Descriptors: *Glaciers, *Alaska, *Canada, *Gradients (Streams), Antarctic, Rheology, Profiles, Slopes, Glaciation, Paleohydrology, Pleistocene epoch.
Identifiers: *Greenland, *Gradients (Glaciers).

Gradients were calculated for a large number of outlet glaciers entering fjords in Alaska, Greenland, Antarctica and Arctic Canada. A linear relationship exists between the overall length and the gradient of these glaciers. This method finds application in the reconstruction of ice surfaces of former outlet glaciers in areas previously glaciated, and an example from Baffin Island is discussed. (Knapp-USGS)
W72-10916

RATE OF WATER OUTFLOW FROM CELLS OF FROST RESISTANCE PLANTS AT NEGATIVE TEMPERATURES (IN RUSSIAN),
Akademii Nauk SSSR, Moscow. Inst. of Plant Physiology.
For primary bibliographic entry see Field 02I.
W72-10943

INFLUENCE OF ALTERNATE FREEZING AND THAWING ON THE AVAILABILITY OF SOME SOIL MINERALS,
Department of Agriculture, Quebec.
For primary bibliographic entry see Field 02G.
W72-11026

WATER-RETENTION CAPACITY AND HYDROPHILY OF GRAPEVINE COLLOIDS IN CONNECTION WITH FROST RESISTANCE (IN RUSSIAN),
Ukrainskii Nauchno-Issledovatel'skii Institut Vinogradarstva i Vinodeliya, Odessa (USSR).
For primary bibliographic entry see Field 02I.
W72-11053

Field 02—WATER CYCLE

Group 2C—Snow, Ice, and Frost

THE VAPOR PRESSURE OF ICE BETWEEN 0.01 AND -100 DEG.
Tennessee Univ., Knoxville. Dept. of Chemistry.
G. Jancso, J. Pupuzin, and W. A. Van Hook.
Journal of Physical Chemistry, Vol 74, No 15, p
2984-2989, 1970. 3 fig, 1 tab, 47 ref. OWRR A-012-
TENN (1).

Descriptors: *Ice, *Cryology, *Vapor pressure,
*Thermodynamics, Laboratory tests, Equations,
Temperature, Physical properties.
Identifiers: Triple point (Water).

A new calculation and new measurements of the vapor pressure of ice were made between -100 deg and the triple point. The high precision of the available thermodynamic data allows the relative vapor pressure of ice to be determined with a better precision than that with which it has been measured. Accurate calculation was tested with experimental vapor pressure data. The equipment employed in the work was designed to measure isotopic vapor pressure differences with high precision and accuracy. Two samples are held inside a common copper block which rests in a thermostated oil bath. The temperature of the bath is controlled to 0.001 deg. (Woodard-USGS)
W72-11083

2D. Evaporation and Transpiration

FREQUENCY OF POTENTIAL EVAPOTRANSPIRATION RATES IN CENTRAL GREAT PLAINS,
Nebraska Univ., Lincoln. Dept. of Horticulture and Forestry.
N. J. Rosenberg.

Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 98, No. IR 2, p 203-206, June 1972. 2 fig, 2 ref.

Descriptors: *Evapotranspiration, *Lysimeters, *Soil moisture, *Advection, *Great Plains, Crop response, Soybeans, Alfalfa, Nebraska, Agronomic crops, Irrigation efficiency.
Identifiers: *Potential evapotranspiration, *Soil water potential.

As part of a study designed to improve crop water use efficiency, daily water use (ET) rates have been measured with precision lysimeters in an irrigated field in eastern Nebraska. Irrigation water was supplied whenever tensiometers and neutron probe access tubes indicated soil water potentials approaching -1 bar in the top 90 cm of soil. Daily ratios of evapotranspiration to net radiation were often greater than 1 for alfalfa and soybeans and therefore indicate strong advection in the region. Maximum ET for both crops has been approximately 12 mm per day. Seasonal frequency distributions of daily ET by a well-watered soybean crop are presented as an aid to irrigation design in the eastern Great Plains region. July is the greatest water use month because full canopy cover has been achieved and advection is high. (Casey-Arizona)
W72-10525

MOISTURE USE ESTIMATION AND RELATIONSHIP BETWEEN MOISTURE USE AND NITROGEN RESPONSE IN WINTER WHEAT,
Kansas Water Resources Research Inst., Manhattan.

R. L. Vanderlip, and L. S. Murphy.
Available from the National Technical Information Service as PB-210 745, \$3.00 in paper copy, \$0.95 in microfiche. Project Completion Report Contribution No. 98, May 1972. 33 p, 10 fig, 11 tab, 40 ref, append. OWRR A-022-Kan (1).

Descriptors: *Soil moisture, *Nitrogen, Rainfall, *Regression analysis, *Kansas, *Wheat, Crop response, Crop production.
Identifiers: *Winter wheat, Seeding rate, *Soil nitrogen, *Estimated soil moisture.

Multiple regression techniques were used to obtain prediction equations relating wheat response to applied nitrogen, soil moisture, rainfall, soil nitrogen content, variety, and seeding rate. Yield variability could be significantly related to these variables in both central and western Kansas. However, coefficients of determination were approximately 0.9 for western Kansas and 0.7 for central Kansas. All variables considered were important in accounting for variability in yields. Crop variables contributed most to prediction followed by moisture and soil nitrogen variables. Applied nitrogen was significantly related to yield, however, it contributed least to the prediction equations. Measured soil moisture at the experimental sites and estimated soil moisture as provided by the Kansas Crop and Livestock Reporting Service each were effective as soil moisture variables as measured by coefficients of determination. However, they did not result in consistent predicted effects of applied nitrogen, spring rainfall or to soil moisture itself. It is anticipated that these or similar equations could be used to provide a guide for spring application of nitrogenous fertilizer.
W72-10803

SUBSURFACE HYDRAULICS IN THE AREA OF THE GILA RIVER PHREATOPHYTE PROJECT, GRAHAM COUNTY, ARIZONA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W72-10898

ON THE INTENSITY OF TRANSPIRATION IN EUONYMUS JAPONICA THUNB. AND MAHONIA AQIFOLIUM NUTT. WITH SPECIAL CONSIDERATION OF THE AGE OF THE LEAVES,
M. Kojic, and T. Cincovic.
Ber Dtsch Bot Ges. Vol 84, No 1/2, p 53-57. 1971.

Identifiers: *Age, Euonymus japonica D, *Leaves, Mahonia aquifolium D, *Transpiration.

At the same location M. aquifolium transpired more intensively than E. japonica. The difference can be up to 10 mg/g min. In general, transpiration in younger leaves is more intensive. The quantity of the difference in young and old leaves varies throughout the year.—Copyright 1972, Biological Abstracts, Inc.
W72-10935

THE MOISTURE AND SALINITY REGIME OF CISCAUCASIAN FLOODPLAIN SOILS,
For primary bibliographic entry see Field 03C.
W72-10999

EFFECT OF COMPACTED INTERCALATION ON SOIL MOISTURE EVAPORATION,
For primary bibliographic entry see Field 03F.
W72-11000

THE CHARACTERISTICS OF LEAF ANATOMY AND DIFFUSION RESISTANCES,
For primary bibliographic entry see Field 02I.
W72-11023

STOMATAL RESISTANCE, TRANSPERSION, AND RELATIVE WATER CONTENT AS INFLUENCED BY SOIL MOISTURE STRESS,
Institute for Research on Natural Resources, Abu-Ghraib (Iraq).
For primary bibliographic entry see Field 03F.
W72-11027

ESTIMATING STEADY-STATE EVAPORATION RATES FROM BARE SOILS UNDER CONDITIONS OF HIGH WATER TABLE,
Geological Survey, Washington, D.C.
C. D. Ripple, J. Rubin, and T. E. A. van Hyckama.
Available from GPO, Washington, DC 20402 Price \$0.30 paper cover. Geological Survey Water-Supply Paper 2019-A, 1972. 39 p, 10 fig, 28 ref.

Descriptors: *Evaporation, *Soils, *Water table, *Estimating equations, Methodology, Meteorological data, Soil water, Air temperature, Humidity, Wind velocity, Soil properties, Mathematical studies.

Identifiers: *Evaporation rates, Steady-state evaporation, Bare soils, High water table.

A procedure that combines meteorological and soil equations of water transfer makes it possible to estimate approximately the steady-state evaporation from bare soils under conditions of high water table. Field data required include soil-water retention curves, water-table depth, and a record of air temperature, air humidity, and wind velocity at one elevation. The procedure takes into account the relevant atmospheric factors and the soil's capability to conduct water in liquid and vapor forms. The evaporation rate can be estimated for homogeneous as well as layered soils. Results demonstrate how the soil-water evaporation rates depend on potential evaporation, water table depth, vapor transfer, and certain soil parameters. (Woodard-USGS)
W72-11079

2E. Streamflow and Runoff

STOCHASTIC HYDRAULICS.
For primary bibliographic entry see Field 08B.
W72-10457

EFFECTIVE USE OF STOCHASTIC INFORMATION WITH DETAILED ANALYTIC MODELS,
Texas Water Development Board, Austin. Systems Engineering Div.
For primary bibliographic entry see Field 08B.
W72-10465

U. S. GEOLOGICAL SURVEY RESEARCH PROGRAM IN STOCHASTIC HYDRAULICS,
Geological Survey, Fort Collins, Colo.
For primary bibliographic entry see Field 08B.
W72-10466

SOURCES OF STREAMFLOW IN A SMALL HIGH COUNTRY CATCHMENT IN CANTERBURY, NEW ZEALAND,
Forest and Range Experiment Station, Rangiora (New Zealand).
H. M. Keller.
Journal of Hydrology, (New Zealand), Vol 6, No 1, p 2-19, 1967. 5 fig, 6 tab, 15 ref.

Descriptors: *Rainfall-runoff relationships, *Small watersheds, *Water chemistry, *Hydrogeology, *Base flow, Water balance, Leaching, Weathering, Demonstration watersheds, International hydrological decade, Stream gages, Discharge measurement, Water yield.
Identifiers: *Experimental watersheds, *New Zealand.

Camp Stream Basin was investigated for its sources of streamflow. It is located in the headwaters of Broken River, Craigieburn Range, Canterbury, New Zealand. Discharge, temperature, and specific conductivity readings at nine locations within the basin were taken during baseflow conditions and used to trace the sources of streamflow. The measurements used the dye-dilution method and the catchment area was sub-divided into three main zones: bush, transition (partly bush and alpine), and alpine. All three zones contributed about equal parts to streamflow. On a unit area basis, however, the transition and alpine zones yielded almost 1 1/2 times as much as the bush zone. Conductivities showed a very strong relationship with discharge. This conductivity/discharge relationship varied considerably between the locations of measurement with a clear trend of increasing values of the regression coefficient with distance from the mouth of the basin. Physical and chemical weathering of vegetation

WATER CYCLE—Field 02

Streamflow and Runoff—Group 2E

cover, soil and parent material affects the water discharged from the catch area above the point of measurement. This is supported by conductivity measurements from seepages and creeks affluent to the stream; they showed generally much higher values in the bush zone than in the alpine. (Knapp-USGS)
W72-10473

CHANGES IN STREAMFLOW FOLLOWING PARTIAL CLEARCUTTING ON A FORESTED WATERSHED,
Pennsylvania Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 04C.
W72-10630

WATER RESOURCES INVESTIGATIONS IN NEW MEXICO, 1969.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-10633

WATER RESOURCES INVESTIGATIONS IN RHODE ISLAND, 1968.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-10634

SEASONAL STREAMFLOW IN THE WEST SIBERIAN PLAIN (SEZONNNY STOK REK ZAPADNO-SIBIRSKOY RAVNINY),
I. N. Stezhenskaya.
Gidrometeoizdat, Leningrad, 1971. 68 p.

Descriptors: Hydrology, *Streamflow, *Runoff, *Discharge (Water), *Seasonal, Spring, Summer, Autumn, Winter, Floods, Low flow, Wet seasons, Dry seasons, Air temperature, Rivers, Watersheds (Basins), Drainage area, Maps, Methodology. Identifiers: *USSR, *Siberia.

This monograph is concerned with the application of geographic and hydrologic methods to investigation of seasonal streamflow in the West Siberian plain. Maps showing areal distribution of temporal and quantitative indices of spring, summer-fall, and winter runoff in average, wet, and dry water years were prepared for 88 drainage basins ranging in size from 286 sq km to 106,000 sq km. Detailed analysis of seasonal regimes of these river basins will provide data needed to plan water-reclamation projects in Western Siberia. (Josefson-USGS)
W72-10659

STREAM-CHANNEL BEHAVIOR AND HYDRAULIC ENGINEERING (DEFORMATSII RECHNYKH RUSEL I GIDROTEKH-NICHESKOYE STROITEL'STVO),
For primary bibliographic entry see Field 08B.
W72-10661

GEOPHYSICAL FORCES AND OCEANIC WATERS (GEOFIZICHESKIYE SILY I VODY OKEANA),
For primary bibliographic entry see Field 02A.
W72-10662

CLUPEIDS IN THE ALTAMAHIA RIVER, GEORGIA,
Georgia Game and Fish Commission, Brunswick. Coastal Fisheries Div.
J. G. Adams.
Available from the National Technical Information Service as COM72-10037, \$3.00 in paper copy, \$0.95 in microfiche. Contribution Series No. 20, June 1970. 29 p., 15 fig, 5 tab, 5 ref.

Descriptors: *Georgia, *Fishing, *Rivers, Resources surveys, *Herrings, Reproduction, Fish migration, Sampling, Spawning. Identifiers: *Altamaha River, Ga.

The Altamaha River was surveyed with seines, trawls, gillnets, and plankton nets from July 1968 to April 1970. During the survey 12,998 eggs, larvae, juveniles and adults of three species of clupeid fishes were collected. American shad spawned primarily between river mile 60 and river mile 120. Hickory shad spawned primarily between river mile 121 and river mile 137, not in the main river channel, but in tributary streams and lakes. Blueback herring spawned primarily from river mile 101 to river mile 120 in backwater areas accessible only during spring flood stages. There was a general downstream movement of larvae until they attained sufficient size for directional movement.
W72-10700

QUANTITATIVE ANALYSIS OF DRAINAGE NETWORKS,
Purdue Univ., Lafayette, Ind. Water Resources Research Center.

J. A. Bunik, and A. K. Turner.

Available from the National Technical Information Service as PB-210 712, \$3.00 in paper copy, \$0.95 in microfiche. Indiana Water Resources Research Center Technical Report No. 22, March 1972. 188 p., 26 fig., 87 ref., append. OWRR-A-007-IND (5).

Descriptors: *Drainage systems, *Stream geomorphology, *Drainage density, *Drainage area, River basins, Watersheds, River systems, *Indiana, *Networks, Computer programs.

Identifiers: *Stream order, *Strahler stream order, *Stream classification, *Ontario (Canada)drainage basins.

The first application of the WATER System of Computer Programs described in Purdue University Water Resources Research Center Technical Report No. 16 is described. The study compiled and analyzed 37 drainage basins developed on materials of various types and ages. Nineteen of these basins were in Ontario, Canada and eighteen in North-Central Indiana. The basins were separated on the basis of parent material, geographical location, and relative geologic age. Each of these groups was then studied individually and compared with other groups. All of the normal number, length, and area statistics plus some special statistics were compiled for each basin and group of basins. The result of these analyses and comparisons was an indication that the position of a subbasin in respect to the headwaters and mouth of the main stream is more important than the geologic age of the basin. Parent material also exercised a major influence upon the network pattern. The stage of development, however, is an even stronger influence upon development than material type. The results also give support to the concept of a drainage basin developing from a hierarchy of unit cells which follow a form of hexagonal determinism. (See also W71-12689) (Wiersma-Purdue)
W72-10705

INTERDISCIPLINARY APPROACH TO FLOOD PLAIN PROBLEMS,
Tennessee Valley Authority, Knoxville.

G. R. Wall, and B. A. Tschantz.

Available from ASCE Publication Office, 345 E. 47th St, New York, N.Y. 10017-Price 50 cents. Meeting Preprint 1598, Paper presented at ASCE National Water Resources Engineering Meeting, January 24-28, 1972, Atlanta, Georgia. 30 p, 3 fig, 12 ref.

Descriptors: *Flood protection, *Flood plains, *Engineering structures, Reviews, Planning, Watershed management, Cooperatives, Flood damage, Flood routing, Evaluation, Land use, Legal aspects, Governments, Community development, Floods.

The necessity for establishing an engineering basis for resolving flood problems is discussed. However, the solution for resolving these problems can best be determined by developing a plan utilizing

the talents of not only engineers but of other disciplines as well. An argument is made for the benefits of, even the necessity of, interdisciplinary cooperation. Emphasis is placed on cooperation as the end result of coordination. Also, a procedure is outlined for use by community leaders in making decisions for resolving flood problems. Before these decisions can be made, community leaders must obtain inputs from a wide variety of disciplines; in short, they should follow the interdisciplinary approach. Two case studies are used to demonstrate the actual application of the ideas presented. (Woodard-USGS)
W72-10718

MEAN AND TURBULENT VELOCITIES FOR PLANE JET,
Washington State Univ., Pullman. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-10720

LAGRANGIAN CHARACTERISTICS OF SURFACE TURBULENCE,
Technical Univ. of Denmark, Lyngby. Inst. of Hydromechanics and Hydraulic Engineering.
For primary bibliographic entry see Field 08B.
W72-10721

CONCEPTUAL HYDROLOGIC MODELS FOR URBANIZING BASINS,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
For primary bibliographic entry see Field 02A.
W72-10723

MODEL TO PREDICT MEAN ANNUAL WATERSHED DISCHARGE,
Federal Highway Administration, Washington, D.C.
For primary bibliographic entry see Field 02A.
W72-10724

BOUNDARY LAYER EFFECTS ON HYDRAULIC JUMP LOCATION,
Surrey Univ., Guildford (England). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 08B.
W72-10725

WATER RESOURCES INVESTIGATIONS IN TEXAS, 1969.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-10726

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR ELM FORK TRINITY RIVER, TRINITY RIVER BASIN, TEXAS, 1970,
Geological Survey, Austin, Tex.
J. N. Sansom.

Geological Survey Open-file Report (Texas District), March 1972. 47 p, 2 fig, 3 tab, append.

Descriptors: *Rainfall-runoff relationships, *Streamflow, *Water storage, *Basic data collections, *Texas, Hydrologic data, Levees, Flood protection, Storms, Hydrographs, Mass curves, Stream gages, Gaging stations, Rain gages, Flow rates, Watershed management, Small watersheds. Identifiers: *Elm Fork Trinity River (Tex.).

This is the eleventh in a series of basic-data reports published annually for the Elm Fork Trinity River study area, and contains the rainfall, runoff, and storage data collected during the 1970 water year for the 46.0-square-mile area above the stream-gaging station Elm Fork Trinity River near Muenster, Texas. Fourteen floodwater retaining structures provide capacity for flood-detention storage of 10,500 acre-feet of flood runoff from

Field 02—WATER CYCLE

Group 2E—Streamflow and Runoff

33.5 square miles of the 46.0-square-mile drainage area. The average rainfall for the 1970 water year was 35.16 inches, or 103% of the 14-year (1957-70) average. The monthly rainfall totals ranged from a low of 0.31 inches in January to a high of 8.43 inches in September. Yearly mean discharge at the stream-gaging station was 20.3 cfs, compared with the 14-year (1957-70) average of 20.1 cfs. Total runoff during the year was 14,860 acre-feet (6.06 inches), which is 17% of the total rainfall. Four storm periods were selected for detailed rainfall and discharge computations. (Woodard-USGS)
W72-10728

ANNUAL COMPILED AND ANALYSIS OF HYDROLOGIC DATA FOR DEEP CREEK, COLORADO RIVER BASIN, TEXAS, 1970, Geological Survey, Austin, Tex.

H. R. Hejl, Jr.
Geological Survey Open-file Report (Texas District), April 1972. 35 p, 2 fig, 2 tab.

Descriptors: *Rainfall-runoff relationships, *Streamflow, *Water storage, *Basic data collections, *Texas, Hydrologic data, Flood protection, Stream gages, Gaging stations, Flow rates, Rain gages, Watershed management, Small watersheds. Identifiers: *Deep Creek (Colorado River Basin, Tex.), Floodwalls.

This is the eleventh in a series of basic-data reports published annually for the Deep Creek study area, and contains the rainfall, runoff, and storage data collected during the 1970 water year for the 43.9-square-mile area above the stream-gaging station Deep Creek near Mercury, Texas, and the 8.31-square-mile area above the stream-gaging station Dry Prong Deep Creek near Mercury, Texas. Six floodwater-retarding structures have a combined total capacity of 7,030 acre-feet and regulate floodflow from 25.31 square miles. The weighted-mean rainfall over the Deep Creek portion of the study area was 26.91 inches and over the Dry Prong Deep Creek portion 22.17 inches—3 and 20 percent, respectively, below the long-term average rainfall of 27.74 inches at Brownwood. The ratio of rainfall to runoff ranged from 2.8 to 5.5 percent. (Woodard-USGS)
W72-10729

ENERGY AND MASS TRANSFER THROUGH AN AIR-WATER INTERFACE, Stanford Univ., Calif. Dept. of Civil Engineering. For primary bibliographic entry see Field 02A. W72-10730

GEOLOGY AND WATER RESOURCES OF THE SPANISH VALLEY AREA, GRAND AND SAN JUAN COUNTIES, UTAH, Geological Survey, Salt Lake City, Utah. For primary bibliographic entry see Field 02F. W72-10732

UNUSUAL TEMPERATURE VARIATIONS IN TWO SMALL STREAMS IN NORTHERN VIRGINIA, Geological Survey, Arlington, Va. E. J. Pluhowski.

Prof. paper 800-B available from GPO, Washington, DC 20402 - Price \$2.25. In: Geological Survey Research 1972, Chapter B; US Geological Survey Professional Paper 800-B, p B255-B258, 1972. 4 fig, 3 ref.

Descriptors: *Water temperature, *Virginia, Weather, Iced lakes, Precipitation (Atmospheric), Solar radiation, Snowfall, Heat balance, Energy budget.

Temporary, unexpected disruptions in the temperature regimen of two small streams in northern Virginia are ascribed to short-term disruptions in the energy balances of the streams. A combination of meteorologic events on February 14-15, 1970, caused unusual water-temperature changes in

Nichols Run near Great Falls, Va. Ice floes on Lake Fairfax near Reston, Va., driven past the lake's flat-crested outlet by high winds on February 11, 1970, caused an anomalous drop of 4 deg C in the receiving waters of Colvin Run. (Knapp-USGS)
W72-10739

THE UPPER BOUND OF A LOG-PEARSON TYPE III RANDOM VARIABLE WITH NEGATIVELY SKEWED LOGARITHMS, Geological Survey, Arlington, Va.

E. J. Gilroy.

Prof. paper 800-B available from GPO, Washington, DC 20402 - Price \$2.25. In: Geological Survey Research 1972, Chapter B; US Geological Survey Professional Paper 800-B, p B273-B275, 1972. 1 tab, 2 ref.

Descriptors: *Statistics, *Variability, *Floods, Peak discharge, Statistical methods, Frequency analysis.

Identifiers: *Log-Pearson distribution.

When a negative skew coefficient is used in fitting a Pearson type III distribution to the logarithms of annual floods, the estimated annual floods are necessarily bounded from above. Thus a numerical value of the upper bound exists. The implications of such a property of the annual floods could be serious depending on the magnitudes of the upper bound, the mean value of the annual floods, and the standard deviation of the annual floods. (Knapp-USGS)
W72-10742

FORMATION OF THE THERMOCLINE STEP STRUCTURE BY LARGE-AMPLITUDE INTERNAL GRAVITY WAVES, Environmental Science Services Administration, Princeton, NJ. Geophysical Fluid Dynamics Lab. I. Orlanski, and K. Bryan.

Journal of Geophysical Research, Vol 74, No 28, p 6975-6983, December 20, 1969. 6 fig, 1 tab, 11 ref.

Descriptors: *Thermocline, *Oceans, Mixing, Convection, Turnovers, Temperature, Velocity, Stability.

Identifiers: Large amplitude, Gravity waves, Energy propagation.

A possible mechanism for the formation of the thermocline step structure is a sporadic overturning by rotors associated with finite-amplitude internal waves. For a two-dimensional flow in a large Reynolds number range in which effects of molecular viscosity and conductivity can be neglected, the equation of state can be written incorporating the temperature of the fluid, the density, the coefficient of thermal expansion and a constant reference density. By means of the Boussinesq approximation, the vorticity and thermal equations are written and solved assuming the basic stratification of the environment to be a constant. Good agreement is found with numerical experiments illustrating the mechanism. A scale analysis for the ocean shows that downward-propagating waves with a vertical wavelength of 10-20 meters would be most favored to break by the convective instability mechanism. Examination of velocity spectra measured in the North Atlantic shows that more than enough energy exists in the internal wave frequency range for this type of instability to occur. (Upadhyaya-Vanderbilt)

W72-10822

SOME RECOMMENDATIONS FOR THE OPERATION OF REPRESENTATIVE AND EXPERIMENTAL BASINS AND THE ANALYSIS OF DATA, Geological Survey Open-file Report (Texas District), January 1972. 66 p, 2 fig, 3 tab, append.

For primary bibliographic entry see Field 02A.
W72-10902

ROLE OF SUBSURFACE FLOW IN GENERATING SURFACE RUNOFF: I. BASE FLOW CONTRIBUTIONS TO CHANNEL FLOW, Thomas J. Watson Research Center, Yorktown Heights, N.Y. For primary bibliographic entry see Field 02A. W72-10905

WATER RESOURCES INVESTIGATIONS IN WEST VIRGINIA, 1968, Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 07C. W72-10918

WATER RESOURCES INVESTIGATIONS IN WASHINGTON, 1968, Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 07C. W72-10919

AN EVALUATION OF CHEMICAL GAUGING TECHNIQUES, Ministry of Works, Wellington (New Zealand).

Water and Soil Div. R. J. Bellamy. New Zealand Ministry of Works Hydrological Research Progress Report No 6, 1971. 8 p, 3 fig, 6 ref.

Descriptors: *Flow measurement, *Turbulent flow, *Streamflow, *Travel time, *Tracers, Methodology, Chemical properties, Dye releases, Tracking techniques, Chemical analyses, Fluorometry, Evaluation, Analytical techniques. Identifiers: Chemical stream gaging.

Two methods for measuring streamflow in turbulent streams are described: (a) The sudden or 'gulp' injection method requires the addition of a known volume of chemical to the stream as rapidly as possible and, at some point downstream, sampling the stream water at regular intervals of time. Concentrations of the chemical in the stream water at the sampling point are determined and a concentration-versus-time curve drawn. (b) The constant-rate injection method requires the addition of the chemical in solution, the dilution of which is approximately known, to the stream at a constant known rate. At a point downstream, samples of stream water are collected at a time when chemical concentration becomes constant, and these samples are analyzed with respect to the initial concentration. Chemical gaging methods are accurate, relatively simple, and have the major advantage of being suited to those conditions which prohibit accurate current meter measurements. The constant-rate injection method is recommended for general use. The chemical used should be sodium dichromate or rhodamine B. Where a colorimeter is available this should be used in preference to volumetric analysis, particularly where large numbers of samples are to be analyzed. (Woodard-USGS)
W72-11068

WATER RESOURCES INVESTIGATIONS IN SOUTH DAKOTA, 1969, Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 07C. W72-11074

ANNUAL COMPILED AND ANALYSIS OF HYDROLOGIC DATA FOR HONEY CREEK, TRINITY RIVER BASIN, TEXAS, 1970, Geological Survey, Austin, Tex.

B. B. Hampton. Geological Survey Open-file Report (Texas District), January 1972. 66 p, 2 fig, 3 tab, append.

Descriptors: *Rainfall-runoff relationships, *Streamflow, *Water storage, *Basic data collections, *Texas, Hydrologic data, Levees, Flood protection, Storms, Hydrographs, Mass curves, Stream gages, Gaging stations, Flow rates, Rain gages, Watershed management, Small watersheds.

WATER CYCLE—Field 02

Groundwater—Group 2F

Identifiers: *Honey Creek (Trinity River Basin, Tex.).

This is the eleventh in a series of basic-data reports published annually for the Honey Creek study area, and contains the rainfall, runoff, and storage data collected during the 1970 water year for the 39.0-square-mile area above the stream-gaging station Honey Creek near McKinney, Texas. There are 13 floodway-retarding structures located in the Honey Creek watershed. The average rainfall for the 1970 water year was 38.03 inches, or 109% of the 17-year (1954-70) average of 34.97 inches. The monthly rainfall totals ranged from 0.06 inch in July to 6.18 inches in September. The yearly mean discharge at the stream-gaging station Honey Creek near McKinney was 28.9 cfs, compared with the 19-year average of 19.3 cfs. Annual runoff at the stream-gaging station was 20,930 acre-feet (10,06 inches). Four storm periods were selected for detailed rainfall and discharge computations. (Woodard-USGS)

W72-11087

2F. Groundwater

APPLICATION OF NONPARAMETRIC STATISTICAL TESTS IN HYDROLOGY, Pennsylvania State Univ., University Park. Mineral Conservation Section.

S. H. Siddiqui, and R. R. Parizek.

Ground Water, Vol 10, No 2, p 26-31, March-April 1972. 2 tab, 12 ref, append. OWRR A-005-PA (5).

Descriptors: *Statistical methods, *Hydrogeology, *Variability, *Computer programs, Sampling, Water yield, Probability, Fracture permeability. Identifiers: Nonparametric statistical tests.

Appropriate nonparametric or distribution-free statistical techniques are useful tools when data do not satisfy the conditions required by parametric statistical tests, and may be applied to a variety of hydrogeological problems. Two nonparametric tests, Krusk-Wallis One-Way Analysis of Variance and Mann-Whitney U Test, were used to test the significance of observed differences in well yields with respect to variation in controlling hydrogeologic factors. The steps involved in performing these two tests are presented with one example for each. Other applications to water-related problems are suggested. To avoid computational errors and save time, a computer program was written for calculating the statistics used in these tests. (Knapp-USGS)

W72-10439

GROUNDWATER OF SIBERIA AND THE SOVIET FAR EAST (PODZEMNYYE VODY SIBIRI I DAL'NEGO VOSTOKA).

For primary bibliographic entry see Field 04B.

W72-10440

RESULTS AND PROBLEMS OF STUDYING INDUSTRIAL MINERAL WATERS OF SIBERIA AND THE SOVIET FAR EAST (ITOGLI I OCHEREDNYYE ZADACHI IZUCHENIYA MINERAL'NYKH PROMYSHLENNYKH VOD SIBIRI I DAL'NEGO VOSTOKA), Vsesoyuznyi Geologicheskii Institut, Leningrad (USSR).

For primary bibliographic entry see Field 04B.

W72-10441

GROUNDWATER RESOURCES OF SIBERIA AND THEIR ROLE IN THE NATIONAL ECONOMY (RESURSY PODZEMNYYKH VOD SIBIRI I IKH ROL' V NARODNOM KHOZYAYSTVE), All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).

For primary bibliographic entry see Field 04B.

W72-10442

BASIC PROBLEMS IN HYDROGEOLOGY (OSNOVNYYE PROBLEMY GIDROGEOLOGII), Moskovskii Geologorazvedochnyi Institut (USSR).

A. M. Ovchinnikov.

In: Podzemnyye vody Sibiri i Dal'nego Vostoka: 'Nauka', Moscow, p 19-22, 1971.

Descriptors: *Hydrogeology, *Groundwater, *Groundwater resources, *Natural resources, Water types, Confined water, Water management (Applied), History, Planning, Analytical techniques, Methodology, Investigations.

Identifiers: *USSR, *Siberia, *Hydrogeochemistry, *Paleohydrogeology, *Nuclear hydrogeology, Mineral deposits.

The study of groundwater in the USSR during 50 years of Soviet rule is examined briefly in connection with the development of 3 new scientific disciplines—hydrogeochemistry, paleohydrogeology, and nuclear hydrogeology—and the application of new techniques to solutions of practical problems. Special emphasis is placed on the importance of groundwater in various geological processes, including the formation of mineral deposits. The increasing complexity of groundwater problems in the national economy calls for establishment of a hydrogeological center administered directly under the USSR Academy of Sciences. (See also W72-10440) (Josefson-USGS)

W72-10443

BASIC PATTERNS IN THE ACCUMULATION OF IODINE, BROMINE, BORON, STRONTIUM, POTASSIUM, BARIUM, AND OTHER TRACE ELEMENTS IN DIFFERENT TYPES OF INDUSTRIAL WATER (OSNOVNYYE ZAKONOMERENIYA NAKOPLENIYA YODA, BROMA, BORA, STRONTSIYA, K ALIYA, BARIYA I DRUGIKH MIKROELEMENTOV V RAZLICHNYKH TIPAKH PROMYSHLENNYKH VOD), All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).

L. V. Slavyanova, and M. S. Galitsyn.

In: Podzemnyye vody Sibiri i Dal'nego Vostoka: 'Nauka', Moscow, p 112-116, 1971. 1 fig, 4 ref.

Descriptors: *Geochemistry, *Trace elements, *Water types, *Industrial water, *Groundwater, Confined water, Connate water, Saline water, Brines, Salts, Halogens, Metals, Alkali metals, Alkaline earth metals, Groundwater basins, Aquifers, Artesian aquifers, Water chemistry, Geologic time.

Identifiers: *USSR, *Hydrogeochemistry.

*Groundwater provinces, *Barium, Lithium, Rubidium, Platforms, Isomorphism, Mineralization.

Trace elements are divided into two groups according to their occurrence in groundwaters of artesian basins. The first group includes Li, Rb, K, Cs, Sr, Ba, B, Br, and I and the second group, the heavy and nonferrous metals. Concentration of trace elements of the first group in groundwater is determined by a number of external migration factors, including amount of total mineralization, ionic composition, temperature, hydrostatic pressure, and the lithologic-facies characteristics of rocks. Extensive distribution of large concentrations of trace elements of the first group in groundwater creates provinces of subsurface lithium, iodine, bromine, and other waters as sources of industrial water. A new genetic classification of subsurface industrial waters, based on origin, occurrence, and chemical and gas composition, includes waters of artesian basins and confined and connate waters of mountain-fold structures. (See also W72-10440) (Josefson-USGS)

W72-10444

THE TYUMEN' DEPOSIT OF INDUSTRIAL THERMAL WATER (TYUMENSKOVE MESTOROZHDENIE PROMYSHLENNYKH TERMAL'NYKH VOD), Tyumenskii Geologorazvedochnyi Trest (USSR).

For primary bibliographic entry see Field 04B. W72-10445

MINERAL WATERS OF THE SIBERIAN PLATFORM (MINERAL'NYYE VODY SIBIRSKOY PLATFORMY), I. S. Lomonosov, S. V. Lysan, and Ye. V. Planeker.

In: Podzemnyye vody Sibiri i Dal'nego Vostoka: 'Nauka', Moscow, p 135-167, 1971. 1 fig, 5 tab, 27 ref.

Descriptors: *Hydrogeology, *Structural geology, Water types, *Mineral water, Groundwater, Groundwater basins, Aquifers, Springs, Brines, Salts, Carbonates, Chlorides, Sulfates, Sulfides, Sodium compounds, Gases, Trace elements, Water chemistry, Water properties, Water utilization.

Identifiers: *USSR, *Siberia, *Artesian basins, Platforms, Mineralization, Balneology.

The occurrence of mineral waters of various compositions in platform areas of East Siberia was examined in connection with the development of a classification of these waters and their separation into groups, classes, and types. In the Siberian Platform, 36 mineral-water types were established. Basic indices used were: (1) mineral concentration; (2) composition of gases, salts, and trace constituents; and (3) physical properties of the water. Geological and hydrogeological prerequisites for mineral-water occurrence are given together with a description of the differentiated classification units. Chemical composition of mineral waters was described and analyzed in terms of their potential utilization for medicinal and industrial purposes. (See also W72-10440) (Josefson-USGS)

W72-10446

MINERAL WATERS IN THE NORTHWESTERN PART OF THE KANSK ARTESIAN BASIN (MINERAL'NYYE VODY SEVERO-ZAPADNOY CHASTI KANSKOGO ARTEZIANSKOGO BASSEYNA), N. N. Shuranova.

In: Podzemnyye vody Sibiri i Dal'nego Vostoka: 'Nauka', Moscow, p 170-173, 1971. 3 tab.

Descriptors: *Mineral water, *Water types, *Water chemistry, *Salinity, *Inorganic compounds, Chlorides, Sulfates, Brines, Nitrogen, Methane, Bromine, Potassium, Artesian aquifers, Springs, Boreholes, Water utilization.

Identifiers: *USSR, *Siberia, *Krasnoyarsk Territory, *Artesian basins, Health resorts, Mineralization.

The Kansk artesian basin is included within the province of nitrogen and methane waters of artesian basins in the Krasnoyarsk Territory in western Siberia. On the basis of a classification adopted by the Leningrad All-Union Scientific Research Institute of Hydrogeology and Engineering Geology, mineral waters of the basin are divided into 3 principal groups: (1) waters with a mineralization of less than 35 g/liter, containing biologically active components of the ionic-salt composition; (2) waters with a mineralization of less than 35 g/liter, differing only in the character of the major ion; and (3) waters with a mineralization of more than 35 g/liter. Mineral waters of the first group include bromine waters of calcium chloride, sodium chloride, and sodium composition, with a mineralization ranging from 3 to 30 g/liter. The second group consists of chloride and sulfate waters and waters of mixed composition, with a mineralization ranging from 1.2 to 31.8 g/liter. Waters of the third group contain various brine concentrations (35.6-374.7 g/liter) with bromine and increased potassium amounts. None of the mineral waters of the Kansk basin is used for medicinal purposes, and only brines are being exploited for industrial-water supply. (See also W72-10440) (Josefson-USGS)

W72-10447

Field 02—WATER CYCLE

Group 2F—Groundwater

FORMATION OF THE CHEMICAL COMPOSITION OF WATERS OF SOME MINERAL SPRINGS IN EASTERN SAYAN (O FORMIROVANII KHMICHESKOGO SOSTAVA VOD NEKOTORYKH MINERAL'NYX ISTOCHNIKOV VOSTOCHNOGO SAYANA), Irkutskii Gosudarstvennyi Universitet (USSR). G. M. Shpeizer, I. M. Borisenko, P. F. Bochkarev, L. A. Charchidi, and N. V. Bektereva.

In: Podzemnye vody Sibiri i Dal'nego Vostoka; 'Nauka', Moscow, p 189-192, 1971. 3 tab.

Descriptors: *Water chemistry, *Chemical analysis, *Mineral water, *Springs, Thermal springs, Hot springs, Cold springs, Igneous rocks, Metamorphic rocks, Carbonate rocks, Alkali metals, Alkaline earth metals, Carbon dioxide, Ions, Water temperature, Hydrogen sulfide, Oxidation-reduction potential, Electrical conductance, Radioactivity, Sampling.
Identifiers: *USSR, *Sayana Mountains, *Mineral springs, Radon.

Investigations were conducted in 1964-66 by the Buryat Geological Administration and Irkutsk State University to study mineral waters of the eastern Sayan Mountain range in Central Asia. On the basis of their genesis, three types of mineral waters were identified: (1) waters formed in comparatively homogeneous limestone-carbonate rocks (Shumak thermal springs); (2) waters formed in igneous and metamorphic rocks (hot and cold carbonic-acid springs of the Sentsa River); and (3) waters formed predominantly in igneous rocks (mineral springs of Nilova Pustyn'). (See also W72-10440) (Jofeson-USGS)
W72-10448

MINERAL WATERS OF THE CHITA OBLAST (MINERAL'NYYE VODY CHITINSKOGO OBLASTI), Chitinskoe Geologicheskoe Upravlenie (USSR). N. S. Bogomolov, A. M. Dikovskiy, A. P. Karaseva, G. I. Klimov, and L. M. Orlova. In: Podzemnye vody Sibiri i Dal'nego Vostoka; 'Nauka', Moscow, p 192-196, 1971.

Descriptors: *Mineral water, *Water types, *Water chemistry, *Structural geology, Fractures (Geologic), Igneous rocks, Metamorphic rocks, Sedimentary rocks, Artesian aquifers, Geologic time, Inorganic compounds, Metals, Gases, Ions, Trace elements, Salinity, Water temperature, Water utilization.
Identifiers: *USSR, *Siberia, *Chita Oblast, *Radon, *Health resorts, Balneology, Mineralization.

Classification of subsurface mineral waters in the Chita Oblast in southeast Siberia was based on ionic and gas composition, mineralization, and concentration of specific constituents. Five principal groups of mineral waters were identified: (1) weakly mineralized siliceous nitrogen waters; (2) subthermal carbonic-acid and nitrogen carbonic-acid waters; (3) cold carbonic-acid waters; (4) nitrogen and radon carbonic-acid waters; and (5) nitrogen iron-bearing waters. Mineral-water types within groups were compared with well-known mineral waters of other regions and divided geologically into 4 categories: (1) deposits associated with deep-seated fractures; (2) deposits confined to the interstitial zone of weathering of igneous and metamorphic rocks; (3) deposits of Paleozoic and Mesozoic metamorphosed sedimentary complexes; and (4) deposits formed in artesian aquifers. Of the 14 types examined, only two are presently exploited by local health resorts. (See also W72-10440) (Jofeson-USGS)
W72-10449

THE INTERNAL STRUCTURE OF OLD FAITHFUL GEYSER AS DEDUCED FROM PHYSICAL EVIDENCE, Montana State Univ., Bozeman. Dept. of Chemical Engineering. J. H. Barbee.

Earth Science Bulletin, Wyoming Geological Association, Vol. 4, No. 4, p 9-16, 1971. 5 fig, 2 tab, 17 ref.

Descriptors: *Geysers, *Subsurface waters, *Thermal water, *Steam, *Pressure, Theoretical analysis, Columns, Reservoirs, Temperature, Geological structures.
Identifiers: *Eruptions.

Theories on the mechanisms of geyser eruption fall into 2 general classes. The 'steam chamber theory' assumes that an underground reservoir is connected to the geyser tube, that the reservoir continually fills with water and empties into a high temperature cavity and boils, and that the resulting steam forms displaces the water-steam mixture up through the geyser tube and out the vent. The 'critical column theory' supposes that a large reservoir full of water is connected to the geyser tube, and that since free circulation is at a minimum in the geyser tube, the water at the bottom of the tube is hotter than the water near the top. The water in the column is unstable because low temperature, high density water is situated above higher temperature, low density water. Eventually either steam or dissolved gases evolve in the lower levels and displace the overlying water and steam. There is little quantitative information available for Old Faithful, but the important known facts are tabulated and interpreted in terms of versions of each theory. It is shown that Old Faithful geyser tube must be fairly long (about 175-200 m) and that the critical column theory applies only to short tube geysers (less than 15 m). The eruption of Old Faithful is therefore probably best described by a modified steam chamber theory than by the critical column theory. (Casey-Arizona).
W72-10511

WATER RESOURCES INVESTIGATIONS IN NEW MEXICO, 1969. Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C.
W72-10633

WATER RESOURCES INVESTIGATIONS IN RHODE ISLAND, 1968. Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C.
W72-10634

GEOCHEMISTRY AND ORIGIN OF FORMATION WATERS IN THE WESTERN CANADA SEDIMENTARY BASIN-III. FACTORS CONTROLLING CHEMICAL COMPOSITION, Research Council of Alberta, Edmonton. B. Hitchon, G. K. Billings, and J. E. Klovan. Geochimica et Cosmochimica Acta, Vol 35, No 2, p 567-598, February 1971. 5 fig, 8 tab, 57 ref.

Descriptors: *Groundwater, *Sedimentary basins (Geologic), *Geochemistry, *Chemical properties, *Canada, Chemical analysis, Water chemistry, Water quality, Data collections, Clays, Rocks, Organic matter, Oil fields, Water analysis.
Identifiers: *Alberta (Canada), Formation waters.

Twenty major and minor chemical components are reported for 78 formation waters from oil fields and gas fields in Alberta, Canada. Published pore volume and chlorinity distribution data were used for a volume-weighted mean composition of formation waters in the western Canada sedimentary basin. The results of Q-mode, R-mode, and second-order R-mode factor analyses are tabulated and interpreted. The volume-weighted mean composition is similar to that of sea water. Dilution by fresh water recharge and concentration by membrane filtration are the major factors controlling chemical composition. Together, they produce a chemical population ranging from freshwater to brines. Quantitative calculations demonstrate that sufficient halite has been dissolved from Middle Devonian evaporite beds to account for the observed gain in NaCl, and that the balance

of halite dissolved from bedded evaporites in the basin has been, and is being, lost to the surface. Other factors controlling chemical composition include cation exchange on clays, a probable contribution of Br and I by desorption from the clay fraction of argillaceous rocks, as well as from organic matter, and solubility control of CaCO₃ and SrSO₄ concentrations. (Woodard-USGS)
W72-10642

STEADY-STATE WELL-FLOW THEORY FOR A HORIZONTAL CONFINED AQUIFER WITH ARBITRARY CONDITIONS ON THE OUTER BOUNDARY, Iowa State Univ., Ames. Dept. of Agronomy. R. R. Van der Ploeg. Ph. D. Thesis, 1972. 151 p, 22 fig, 4 tab, 29 ref. OWRR B-019-1A (3).

Descriptors: *Water wells, *Steady flow, *Confined water, *Aquifer characteristics, *Boundary layers, Theoretical analysis, Analytical techniques, Equations, Correlation analysis, Model studies, *Iowa.
Identifiers: *Ames aquifer (Iowa), Hydraulic head.

Some boundary value problems occurring in groundwater hydrology are solved. Considered are problems of steady-state flow of water to one or more completely penetrating wells in horizontal, confined aquifers of finite extent. The conditions on the outer boundary of the aquifer have to be known but can be arbitrary. The analysis includes mixed boundaries. The outer aquifer boundary can be of irregular shape. A solution to a particular problem is given in the form of a function which gives the hydraulic head at any point in the flow region. With the experience obtained in solving theoretical models an attempt was made to analyze the groundwater flow patterns in the Ames (Iowa) aquifer. The Ames aquifer has many properties of an ideal aquifer; it is nearly horizontal, and of nearly uniform thickness and permeability. The Ames aquifer forms an irregularly shaped, horizontal, confined aquifer, with a variable head distribution along the outer boundary, and with part of the boundary impervious due to the presence of a subsurface impervious boundary segment. Only one pumping well in the Ames aquifer was considered. Discharge values obtained with the newly developed theory agreed with the ones found in practice. (Woodard-USGS)
W72-10647

WATER WELL AND GROUND-WATER CHEMICAL ANALYSIS DATA, REAGAN COUNTY, TEXAS, Texas Water Development Board, Austin. For primary bibliographic entry see Field 04B.
W72-10649

WATER WELL AND GROUND-WATER CHEMICAL ANALYSIS DATA, IRION COUNTY, TEXAS, Texas Water Development Board, Austin. For primary bibliographic entry see Field 04B.
W72-10650

MODELING GROUNDWATER INFILTRATION (MODELIROVANIYE FIL'TRATSII PODZEMNYKH VOD), I. Ye. Zhernov, and V. M. Shestakov. 'Nedra', Moscow, 1971. 224 p.

Descriptors: *Hydrogeology, *Groundwater, *Infiltration, *Model studies, *Analog models, Resistance networks, Electrical resistance, Resistivity, Junctions, Groundwater movement, Flow, Unsteady flow, Steady flow, Aquifers, Pressure, Boreholes, Drains, Instrumentation, Equipment, Equations.
Identifiers: *USSR, Artesian basins, Differential analyzers.

WATER CYCLE—Field 02

Groundwater—Group 2F

The use of model techniques for simulation of groundwater infiltration is examined, with emphasis on electrical-resistance network analogs. Construction, theory, and application of analog models and methods for simulation of steady and unsteady groundwater flow are described. Eight model applications of groundwater infiltration are cited, including (1) modeling of horizontal drainage in a stratified layer; (2) modeling of groundwater flow in a closed artesian basin; (3) modeling of aquifers drained by horizontal boreholes; and (4) modeling of the effects of a radial water intake in a stratified system. (Josefson-USGS)
W72-10657

DEVELOPMENT OF PRESSURE IN GROUNDWATER HORIZONS CAUSED BY STORAGE IN LARGE RESERVOIRS (RAZVITIYE PODPORA V GORIZONTAKH NAPORNYKH VOD PRI SOZDANIYI KRUPNYKH VODOKRANILISHCH),
All-Union Research Inst. of Marine Geology and Geophysics, Riga (USSR).
V. Ya. Starens.
'Zinatne', Riga, 1970. 47 p.

Descriptors: *Hydrogeology, *Groundwater, *Water pressure, *Reservoirs, *Reservoir storage, Reservoir construction, Hydroelectric plants, Discharge (Water), Hydrostatic pressure, Pressure head, Hydraulic gradient, Water levels, Water level fluctuations, Potentiometric level, Water table, Confined water, Aquifers, Piezometers, Forecasting.
Identifiers: *USSR, Latvian SSR.

Investigations of the development of pressure in groundwater storage were begun in 1964 by the Latvian All-Union Scientific Research Institute of Marine Geology and Geophysics in connection with changes in hydrogeological conditions in the vicinity of the Plavinas and Riga hydroelectric plants as a result of reservoir construction. A new method was proposed for forecasting the increase in pressure in areas adjacent to the reservoirs and for estimating the expected rise in the groundwater table. Applicability of the formulas was checked in the fall of 1968 in the laboratory and under field conditions along the right bank of the reservoir near the Plavinas powerplant. (Josefson-USGS)
W72-10658

GROUNDWATER IN PALEOZOIC DEPOSITS OF THE NORTH CASPIAN REGION (PODZEMNYYE VODY PALEOZOYA SEVERNOGO PRIKASIPIYA),
K. Ye. Pit'yeva.
Izdatel'stvo Moskovskogo Universiteta, Moscow, 1971. 356 p.

Descriptors: *Groundwater, *Groundwater movement, *Geologic time, *Paleozoic era, *Hydrogeology, Areal hydrogeology, Aquifers, Water chemistry, Water quality, Water analysis, Geochemistry, Hydrodynamics, Mineralogy, Sedimentation, Petrology, Rocks, Facies (Sedimentary), Trace elements, Distribution patterns, Correlation analysis.
Identifiers: *USSR, *Orenburg Oblast, *Caspian Sea, Devonian period, Carboniferous period, Permian period, Paleohydrogeology, Hydrochemistry, Facies maps, Tectonics.

This four-part monograph on groundwaters of the Orenburg Oblast is the product of extensive hydrogeological and hydrochemical investigations conducted in the 1960's by the Orenburg laboratory of the All-Union Petroleum Scientific Research Institute of Geologic Exploration and the hydrogeological laboratory of the Kuybyshev Scientific Research Institute of the Petroleum Industry. The hydrogeological and hydrochemical conditions of the region are described including the chemical composition of groundwaters in aquifers of Devonian, Carboniferous, and Permian deposits. The hydrochemical characteristics of

Paleozoic aquifers are examined including the distribution of trace elements in different hydrochemical media and the relation of hydrochemical patterns to rock structure. Mineralogical and chemical composition of the rocks and hydrogeochemical zoning of the area are described. (Josefson-USGS)
W72-10660

STEADY INFILTRATION FROM SOURCES AT ARBITRARY DEPTH,
Agricultural Research Service, Madison, Wis. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02G.
W72-10715

WATER RESOURCES INVESTIGATIONS IN TEXAS, 1969.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-10726

GROUND WATER IN THE TERESINA-CAMPO MAIOR AREA, PIAUI, BRAZIL,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04B.
W72-10727

GEOLGY AND WATER RESOURCES OF THE SPANISH VALLEY AREA, GRAND AND SAN JUAN COUNTIES, UTAH,
Geological Survey, Salt Lake City, Utah.
C. T. Sumson.

Utah Department of Natural Resources Technical Publication No 32, 1971. 45 p, 4 fig, 3 plate, 11 tab, 31 ref.

Descriptors: *Water resources, *Geology, *Hydrogeology, *Water supply, *Utah, Valleys, Groundwater, Surface waters, Data collections, Water balance, Water wells, Aquifer characteristics, Water yield, Withdrawal, Groundwater recharge, Water levels, Water quality, Streamflow, Precipitation (Atmospheric), Snowmelt, Vegetation, Evapotranspiration, Hydrologic data.
Identifiers: *Spanish Valley (Utah).

Snowfall in the upland areas of Spanish Valley, Utah, contributes to most of the groundwater recharge. Groundwater occurs under water-table conditions in the valley fill, which consists generally of gravelly sand. The long-term specific yield of the valley fill is estimated to be about 0.25, and total groundwater storage about 200,000 acre-feet.

Aquifer characteristics vary throughout the valley. Well yields may be as much as 1,000 gpm with only 35 feet of drawdown. Inflow to the valley is about 115,000 acre-feet annually from precipitation; of this, about 28,000 acre-feet is discharged annually from Spanish Valley by surface streams and from the groundwater reservoir, and the remainder is discharged by evapotranspiration. Annual recharge to discharge from the groundwater basin are estimated to be 14,000 acre-feet. Only 3,300 acre-feet is used for beneficial purposes in the valley. Of the remainder, groundwater outflow to the Colorado River is estimated to be 8,000 acre-feet, and about 3,000 acre-feet is consumed in an area of phreatophytes and hydrophytes. Groundwater in the valley fill in the southeast part of Spanish Valley contains the greatest concentration of dissolved solids in the area and is not suitable for public supply. Groundwater entering Spanish Valley from the northeast through sandstones of the Glen Canyon Group is suitable for public supply. (Woodard-USGS)
W72-10732

ECONOMIC OPTIMIZATION OF A SINGLE-CELL AQUIFER,
Washington Univ., Seattle. Dept. of Economics.
For primary bibliographic entry see Field 04B.
W72-10783

SUBMARINE SPRING EXPLORATIONS: NORTHWEST COAST OF PUERTO RICO,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
For primary bibliographic entry see Field 07B.
W72-10896

SUBSURFACE HYDRAULICS IN THE AREA OF THE GILA RIVER PHREATOPHYTE PROJECT, GRAHAM COUNTY, ARIZONA,
Geological Survey, Washington, D.C.
R. L. Hanson.

Available from GPO, Washington, DC 20402, Price \$0.40 (Paper cover). Geological Survey Professional Paper 655-F, 1972. 27 p, 16 fig, 13 tab, 13 ref.

Descriptors: *Hydrogeology, *Groundwater, *Aquifers, *Hydrologic data, *Arizona, Data collections, Storage coefficient, Transmissivity, Alluvium, Phreatophytes, Water wells, Water balance, Geology, Aquifer characteristics, Drawdown, Groundwater movement, Water yield, Hydraulic conductivity, Diffusivity, Groundwater recharge.
Identifiers: *Gila River (Ariz), *Graham County (Ariz).

The primary objective of the Gila River Phreatophyte Project is to evaluate evapotranspiration from an analysis of all the significant components comprising the hydrologic system. The two principal hydraulic properties evaluated are the storage coefficient and the transmissivity for both the basin fill and the overlying alluvium along a 15-mile reach of the Gila River valley upstream from the San Carlos Reservoir in south-central Arizona. The basin fill consists of silt, sand, and clay estimated to be more than 1,000 feet thick. The alluvium consists of as much as 60 feet of gravel, sand, and silt and fills a 6,000-foot-wide valley incised in the basin fill. The average storage coefficients for the basin fill and alluvium are 0.0005 and 0.15, respectively. The average transmissivities for the basin fill and alluvium are 15 cubic feet per day per foot and 28,000 cubic feet per day per foot, respectively. Estimates of hydraulic conductivity are 0.015 foot per day for the basin fill and 695 feet per day for the alluvium. Downvalley groundwater flow through the alluvium averages 5.1 acre-feet per day. Estimates of flow from the basin fill into the overlying alluvium range from 0.14 to 2.4 acre-feet per day per mile of valley length. A section on aquifer tests by S. G. Brown, is included. (Woodard-USGS)
W72-10898

GEOLGY AND GROUND WATER OF THE MOLALLA-SALEM, SLOPE AREA, NORTHERN WILLAMETTE VALLEY, OREGON,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04B.
W72-10899

HYDROLOGIC RECONNAISSANCE OF THE BLUE CREEK VALLEY AREA, BOX ELDER COUNTY, UTAH,
Geological Survey, Salt Lake City, Utah.
For primary bibliographic entry see Field 04B.
W72-10900

ROLE OF SUBSURFACE FLOW IN GENERATING SURFACE RUNOFF: I. BASE FLOW CONTRIBUTIONS TO CHANNEL FLOW,
Thomas J. Watson Research Center, Yorktown Heights, N.Y.
For primary bibliographic entry see Field 02A.
W72-10905

USE OF SUBJECTIVE INFORMATION IN ESTIMATION OF AQUIFER PARAMETERS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources; and Arizona Univ., Tucson. Dept. of Systems Engineering.
R. E. Lovell, L. Duckstein, and C. C. Kisiel.

Field 02—WATER CYCLE

Group 2F—Groundwater

Water Resources Research, Vol 8, No 3, p 680-690, June 1972. 3 fig, 4 tab, 13 ref. OWRR B-007-ARIZ (24).

Descriptors: *Mathematical models, *Calibrations, *Hydrogeology, *Aquifer characteristics, Parametric hydrology, Groundwater movement, Water yield, Model studies, Water levels, Numerical analysis.

In the calibration of aquifer models, the desire for an automated adjustment process is sometimes in conflict with the need for subjective intervention during the calibration process. Working from the established concept of modeling for unconfined aquifers with rectangular nodes, a method is described of obtaining subjective information in addition to that customarily used in model calibration. Such information is assembled and quantified at the same time as the usual data are gathered for initial estimation of parameters. This information is then introduced into an automatic adjustment process in such a way that the calibration process can proceed without interruption until the desired level of relative accuracy is reached, or until it is shown that the desired level cannot be reached within the constraints assigned. A decoupling technique that permits simultaneous adjustment of all parameters is also described. A digital computer model of the Tucson basin aquifer is used to illustrate the concepts and demonstrate the adjustment method. (Knapp-USGS) W72-10906

WATER-RESOURCES INVESTIGATION USING ANALOG MODEL TECHNIQUES IN THE SAUGUS-NEWHALL AREA, LOS ANGELES COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
S. G. Robson.
Geological Survey Open-file Report, February 10, 1972. 58 p, 12 fig, 9 plate, 8 tab, 16 ref.

Descriptors: Water resources development, *Hydrologic data, *Analog models, *Projections, *California, Groundwater, Surface waters, Water quality, Water analysis, Water storage, Aquifer characteristics, water yield, Transmissivity, Storage coefficient, Streamflow, Groundwater recharge, Planning, Imported water, Water supply, Data collections.
Identifiers: *Los Angeles County (Calif.).

The Saugus-Newhall area in the upper Santa Clara River valley in northwestern Los Angeles County, California, has two main aquifers, the alluvial aquifer and the underlying Saugus aquifer. The alluvial aquifer consists of river channel alluvium as much as 200 feet thick with a transmissibility ranging from 50,000 to 325,000 gallons per day per foot and a storage coefficient of 10% to 20%. The Saugus aquifer has a maximum saturated thickness of about 3,500 ft and ranges in transmissibility from 2,000 to 200,000 gpm per ft. An analog model of the groundwater basin indicates that it will not be possible to artificially recharge the proposed quantities of imported water into the alluvial aquifer above Saugus unless groundwater pumping from that area is increased. The alluvial aquifer may not be able to supply enough water, even when artificially recharged with imported water, to meet the estimated maximum pumping rate in 1990. Hydrologic and water-quality data are presented for ground and surface waters. (Woodard-USGS) W72-10912

WATER RESOURCES INVESTIGATIONS IN WEST VIRGINIA, 1968.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-10918

WATER RESOURCES INVESTIGATIONS IN WASHINGTON, 1968.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-10919

GROUND-WATER RESOURCES OF THE YUCCA VALLEY-JOSHUA TREE AREA, SAN BERNARDINO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 04B.
W72-11070

WATER RESOURCES INVESTIGATIONS IN SOUTH DAKOTA, 1969.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-11074

HYDROGEOLOGIC DATA FOR THE NORTHERN HIGH PLAINS OF COLORADO,
Geological Survey, Lakewood, Colo.
For primary bibliographic entry see Field 07C.
W72-11080

GROUNDWATER IN POLK COUNTY, NEBRASKA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-11081

AVAILABILITY AND QUALITY OF GROUND-WATER IN THE ASHLAND QUADRANGLE, JACKSON COUNTY, OREGON,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-11082

RECHARGE OF TURID WATER TO THE OGALLALA AQUIFER THROUGH A DUAL-PURPOSE WELL,
Southwestern Great Plains Research Center, Bushland, Tex.
For primary bibliographic entry see Field 04B.
W72-11084

2G. Water in Soils

EFFECT OF GYPSUM FINENESS ON THE COMPOSITION OF SATURATION EXTRACT OF A SALINE SODIC SOIL,
Central Soil Salinity Research, Inst., Karnal (India).

B. K. Khosla, and I. P. Abrol.
Soil Science, Vol. 113, No. 3, p 204-206, 1972. 3 tab, 2 ref.

Descriptors: *Particle size, *Gypsum, *Soil amendments, *Carbonates, *Bicarbonates, Alkaline soils, Saline soils, Calcium, Reclamation.
Identifiers: *Saline-sodic soils.

Gypsum is used as an amendment for sodic soils to increase Ca levels. In many soils, a major amount of the added gypsum is utilized in neutralizing or precipitating the soluble carbonates and bicarbonates. It follows that in these types of highly deteriorated soils, the minimum amount of gypsum necessary to initiate crop growth must be in addition to the amounts needed for carbonate and bicarbonate neutralization. The effects of varying fineness of gypsum on the composition of the saturation extract of a saline sodic soil were studied. Gypsum of a size finer than 0.59 mm was more effective than coarser grades since free carbonates result in the formation of insoluble calcium carbonate coating on the surface of coarse gypsum particles. (Casey-Arizona) W72-10523

SAND-SEAWATER INTERACTIONS IN BERMUDA BEACHES,
Oregon State Univ., Corvallis. Dept. of Oceanography.

R. M. Pytkowicz.
Geochimica et Cosmochimica Acta, Vol 35, No 2, p 509-515, February 1971. 1 fig, 2 tab, 17 ref. NST Grant GA-17011.

Descriptors: *Sands, *Sea water, *Beaches, *Cohesionless soils, *Pore water, Investigations, Analytical techniques, Sediments, Sedimentology, Marine microorganisms, Saturation, Alkalinity, Hydrogen ion concentration, Carbon dioxide, Salinity, Soil water movement.
Identifiers: *Bermuda beaches.

Surface seawater off several Bermuda beaches and in the upper few inches of intertidal sands is several-fold supersaturated with calcium carbonate. Precipitation of calcium carbonate and cementation of these sands is prevented by protective coatings. The depression of the pH by the oxidation of organic matter causes solution of calcium carbonate from deeper sands of the intertidal zone. Data on the pH, alkalinity, satiometry, and CO₂ for the pore water of intertidal sands for several beaches are tabulated. (Woodard-USGS) W72-10637

INFRARED SPECTRA OF HUMIC ACIDS AND RELATED SUBSTANCES,
Illinois Univ., Urbana. Dept. of Agronomy.
For primary bibliographic entry see Field 05A.
W72-10640

FUNDAMENTALS OF SOIL MOISTURE. VOLUME II: INVESTIGATION TECHNIQUES OF SOIL WATER REGIME (OSNOVY UCHENIYA O POCHVENNOY VLAGE. TOM II: METODY IZUCHENIYA VODNOGO REZHIMA POCHV),
A. A. Rode.
Gidrometeoizdat, Leningrad, 1969. 288 p.

Descriptors: *Soil physics, *Soil moisture, *Moisture content, *Water types, Soil water, Soil water movement, Groundwater, Water storage, Soil types, Soil properties, Energy, Meteorology, Agriculture, Crops, Forests, Fallowing, Instrumentation, Measurement, Analytical techniques, Sampling.
Identifiers: *USSR, Agrohydrology, Sod-Podzolic soils, Chronoisopleths.

This revision of the original edition of Volume II published in 1960 incorporates the latest methods of soil-moisture measurements, including gamma-ray, neutron, and optical determinations. Soil-moisture constants, energy relations in soil-moisture phenomena, and 'tagging' of soil moisture to study its movement are examined in connection with investigations of soil physical and hydraulic properties. Soil-hydrologic calculations are accompanied by methods for tabular and graphic presentation of soil-moisture data. (Josephson-USGS) W72-10663

CALCULATION OF THE WATER AND HEAT REGIME OF UNDRAINED BOGS (VODNO-TEPLOVY REZHIM NEOSUSHENNYKH BOLOT I YEGO RASCHET),
S. A. Chechkin.
Gidrometeoizdat, Leningrad, 1970. 206 p.

Descriptors: *Bogs, *Water balance, *Heat balance, Moisture content, Water properties, Thermal properties, Heat flow, Temperature, Freezing, Thawing, Frozen ground, Peat, Snow cover, Vegetation, Topography, Meteorology, Seasonal, Variability, Evaluation, Forecasting.
Identifiers: *USSR, Active layer, Hygroscopicity, Hodographs, Nomograms.

Spatial and temporal variability of the active layer of undrained bogs during individual periods of growth is examined as a function of both the moisture content of deposits and the vertical distribution of their water and heat properties. Particular attention is given to direct and indirect methods of assessing the freezing and thawing of undrained bogs and temporary winter roads constructed on them. (Josephson-USGS) W72-10664

WATER CYCLE—Field 02

Water in Soils—Group 2G

USE OF ISOTOPES AND RADIATION IN RESEARCH ON SOIL-PLANT RELATIONSHIPS INCLUDING APPLICATIONS IN FORESTRY. REVIEW OF THE JOINT FAO/IAEA SYMPOSIUM HELD AT VIENNA, DEC. 13-17, 1971, International Atomic Energy Agency, Vienna (Austria).

For primary bibliographic entry see Field 03F.
W72-10679

THE HYGROSCOPIC WATER IN FOREST SOILS, (IN CZECH),
Vysoka Skola Zemedelska, Brno (Czechoslovakia). Fakulta Lesnicka.

K. Krontorad.

Ved Cas Ustav Veddeckotech Inform Les. Vol 15 No 7 p 615-626. 1969. Illus. (English summary).
Identifiers: Adsorption, Capillary condensation, *Forest soils, *Hygroscopic water, Isotherms.

With any sample the adsorption isotherm exhibits the sigmoid shape. Physical sorption and capillary condensation occur within the supply of hygroscopic soil water. The amount of water absorbed in the soil depends mainly on the active surface of colloidal particles, on the type of exchangeable cations, and on the character of humus. In the mountain humus podzols the amount of Fe is presumably of significance. In the soils saturated predominantly by bivalent cations (e.g. chernozem soil overlying loess) the physical sorption of water prevails over the process of capillary condensation; in unsaturated, leached podzolic layers the reverse is true. The portion of organic matter plays an important part in the content of hygroscopic water. The highest sorption power of water was found in raw humus. In spite of the acid character of humus, due to the prevalence of fulvic acids, a high rate of water adsorption was estimated. Raw humus likewise showed the largest specific surface.—Copyright 1972, Biological Abstracts, Inc.
W72-10687

INFILTRATION RATE AS AFFECTED BY SOIL FREEZING UNDER THREE COVER TYPES,
Forest Service (USDA), La Crosse, Wis. Watershed Lab.

A. R. Harris.

Soil Science Society of America Proceedings, Vol 36, No 3, p 489-492, May-June 1972. 1 fig, 1 tab, 12 ref.

Descriptors: *Infiltration, *Frozen soils, *Frost, *Forest soils, Freezing, Snowmelt, Ice, Snow, Forestry, Rainfall-runoff relationships, Permeability, Floods, Storm runoff, Wisconsin, Snowpacks.

Identifiers: *Soil cover.

Infiltration rate in a frozen Fayette silt loam soil under contiguous areas of natural deciduous forest, 25-year-old coniferous plantation, and 6-year-old abandoned field vegetation was measured over the winter of 1969-70 using tin can infiltration and a water-ethylene glycol solution. The deciduous forest site had a natural soil profile; the conifer plantation and abandoned field sites were once cultivated. Prefreeze infiltration rate was similar for all cover conditions. In deciduous forest and abandoned field plots, soil freezing did not change the infiltration rate sharply until late winter when infiltrating snowmelt and rainfall froze and closed soil pores. In the conifer plantation, the infiltration rate was nearly zero in early winter due to an impermeable snow-ice layer on the ground caused by snowmelt dripping from the conifer canopy. Because of large macropores, infiltration rates were high on the deciduous forest and abandoned field plots even when the frozen soil contained nearly 50% water by volume. Conifer plantations may thus contribute more surface runoff than deciduous forest or abandoned fields during snowmelt and winter rains. (Knapp-USGS)
W72-10708

SOLUBILITY OF SILICA IN SOILS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
S. M. Elgawhary, and W. L. Lindsay.
Soil Science Society of America Proceedings, Vol 36, No 3, p 439-442, May-June 1972. 4 fig, 1 tab, 16 ref.

Descriptors: *Silica, *Solubility, *Soil water, *Water chemistry, Quartz, Hydrogen ion concentration, Aqueous solutions, Colloids, Soil chemistry, Adsorption.

A solubility diagram shows the activity of various ionic and molecular species of Si in equilibrium with amorphous silica as a function of pH. Below pH 8.0 only uncharged Si (OH_4^-) contributes significantly to total soluble Si. The solubility of Si was measured on two soils in which equilibrium was approached from both undersaturation and supersaturation over a 50-day period. In this study, 0.02M CaCl_2 was included in all suspensions during their equilibration to flocculate colloidal Si and preclude its inclusion as soluble Si. Acid Paxton soil supported approximately 19 ppm of Si in solution while calcareous Ulysses soil supported 25 ppm. These levels are intermediate between the solubility of quartz (2.8 ppm Si) and amorphous silica (51 ppm Si) and lie very near the level predicted for equilibrium between kaolinite and montmorillonite based on thermodynamic calculations. (Knapp-USGS)
W72-10709

ION MOBILITIES AND ELECTRIC CHARGE OF EXTERNAL CLAY SURFACES INFERRED FROM POTENTIAL DIFFERENCES AND OSMOTIC FLOW,
Agricultural Research Service, Beltsville, Md. Soils Lab.

W. D. Kemper, and J. P. Quirk.

Soil Science Society of America Proceedings, Vol 36, No 3, p 426-433, May-June 1972. 11 fig, 1 tab, 18 ref.

Descriptors: *Clays, *Osmosis, *Membrane processes, *Electro-osmosis, Chlorides, Ion exchange, Adsorption, Zeta potential, Electrochemistry, Soil water movement, Ion transport. Identifiers: Ion mobility.

Bentonite, illite, and kaolinite clays were compacted, made homoionic with various cations, and placed between chloride solutions of different concentrations. Rates of osmotic flow, electric potentials in the solutions, and streaming potentials were measured across these compacted clay membranes. The osmotic flow was often from the high salt to low salt concentration side and was generally in the direction of more negative potential, indicating electroosmosis as the mechanism involved in osmotic flow. Diffuse layer theory was used to estimate the concentration ranges in which the measured external potential differences were not appreciably different from the respective potentials in solution inside the clay. Assuming the osmotic movement to be electroosmosis, the potentials were calculated from the observed potential gradients and the osmotic flux. The portion of adsorbed cations participating in the diffuse portion of the double layer was then calculated. This mobile fraction of the adsorbed cations appears to decrease for multivalent cations as the equilibrium solution concentration decreased. The mobile fractions estimated by this method for bentonite are in reasonably good agreement with mobile fractions estimated from diffusion and conductance measurements. (Knapp-USGS)
W72-10710

CLAY-WATER INTERACTION, THE BEHAVIOR OF H-3 AND H-2 IN ADSORBED WATER, AND THE ISOTOPIC EFFECT,
Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.

For primary bibliographic entry see Field 02K.
W72-10711

RELATIVE FLOW RATES OF SALT AND WATER IN SOIL,
California Univ., Davis. Dept. of Water Science.
H. K. Krupp, J. W. Biggar, and D. R. Nielsen.
Soil Science Society of America Proceedings, Vol 36, No 3, p 412-417, May-June 1972. 6 fig, 2 tab, 21 ref.

Descriptors: *Soil water movement, *Ion transport, *Tracers, Salts, Tritium, Chlorides, Dispersion, Mixing, Diffusion, Saline water-freshwater interfaces, Leaching, Translocation, Seepage, Adsorption.

Identifiers: Miscible displacement.

A hydrodynamic equation for the mixing of two miscible solutions in porous media was combined with the Gouy theory for ion distribution in soil pores in order to examine the effect of flow velocity and ion distribution in the pores on the breakthrough curves. The model considers zones of mobile and immobile solution in the porous media, and the extent these zones are affected by the total concentration of the solution and the pore water velocity. Miscible displacement experiments of Cl-36 and tritium through Pancoke clay loam at 0.1, 0.01, and 0.001 N total salt concentration using CaCl_2 were performed on the same column at a fast and slow flow velocity. The exclusion volume for isotope and the separation volume for Cl-36 and tritium increased as flow velocity decreased, and these changes are related to the total ion concentration, the thickness of the diffuse double layer, and the zones of mobile and immobile solution. (Knapp-USGS)
W72-10712

SEEPAGE THROUGH SOIL BEDDING OR A HILLSIDE DUE TO A STEADY RAINFALL: I. SOIL SURFACE OF CONSTANT SLOPE,
Iowa State Univ. of Science and Technology, Ames. Dept. of Agronomy.

M. S. Selim, and D. Kirkham.

Soil Science Society of America Proceedings, Vol 36, No 3, p 402-407, May-June 1972. 5 fig, 1 tab, 10 ref.

Descriptors: *Infiltration, *Path of pollutants, *Contour furrows, *Rainfall-runoff relationships, Soil water movement, Drainage systems, Drainage water, Leaching, Seepage.

A theoretical solution is given for the seepage of steady rainfall through soil bedding (a series of formed parallel mounds and depressions, or furrows used in land drainage when soil overlies an impermeable layer). The solution considers a finite depth of water in the bedding depression or furrow. The geometry on an extended scale can be considered as that of a hillside with water seeping to a river, or, on a small scale, as that of the side of a water-saturated ridge-furrow combination in a row-crop field. The rainfall enters the soil, moves downslope in the soil and then moves upward out of the soil, carrying soluble chemicals, such as fertilizers, insecticides, etc. This upward moving soil solution merges into surface runoff. (See also W72-10714) (Knapp-USGS)
W72-10713

SEEPAGE THROUGH SOIL BEDDING OR A HILLSIDE DUE TO A STEADY RAINFALL: II. SOIL SURFACE OF ARBITRARY SHAPE,
Iowa State Univ. of Science and Technology, Ames. Dept. of Agronomy.

M. S. Selim, and D. Kirkham.

Soil Science Society of America Proceedings, Vol 36, No 3, p 407-412, May-June 1972. 5 fig, 1 tab, 10 ref.

Descriptors: *Infiltration, *Path of pollutants, *Contour furrows, *Rainfall-runoff relationships, Soil water movement, Drainage systems, Drainage water, Leaching, Seepage.

Seepage of steady rainfall through soil bedding or a hillside, with arbitrary slope soil surface, was analyzed. Two different shapes for the soil surface

Field 02—WATER CYCLE

Group 2G—Water in Soils

are considered in detail. The first shape is part of the boundary of an ellipse, and the second includes ponded water-depressions. Flow nets, seepage velocities, and infiltration rates were determined. The seepage patterns show that some of the rainwater seeps into the soil on the uphill part of the slope and then flows through the soil more or less parallel to the soil surface. The water then seeps upward out of the soil on the downhill part of the slope. In one example, the inward and then outward flow occurs three times. With an elliptical shaped water table, the upward seepage occurs over a smaller portion of the bedding than for rectilinear (constant slope) bedding. The in and out seepage of water may cause leaching of nutrients and other chemicals from the soil. (See also W72-10713) (Knapp-USGS)
W72-10714

STEADY INFILTRATION FROM SOURCES AT ARBITRARY DEPTH, Agricultural Research Service, Madison, Wis. Soil and Water Conservation Research Div.

P. A. C. Raats.
Soil Science Society of America Proceedings, Vol 36, No 3, p 399-401, May-June 1972. 8 ref.

Steady infiltration is discussed, based on the assumption that the hydraulic conductivity is an exponential function of the pressure head. The solution for infiltration from a single point source at arbitrary depth is presented. On the basis of this solution, superposition theorem for surface sources is generalized to an arbitrary distribution of sources at arbitrary depths. General expressions for the pressure head, the total head, and the components of the flux are also given. (Knapp-USGS)
W72-10715

SYSTEMATIC AND RANDOM ERRORS IN DUAL GAMMA ENERGY SOIL BULK DENSITY AND WATER CONTENT MEASUREMENTS, Washington State Univ., Pullman. Dept. of Soil Science.

W. H. Gardner, G. S. Campbell, and C. Calissendorff.
Soil Science Society of America Proceedings, Vol 36, No 3, p 393-398, May-June 1972. 5 fig, 2 tab, 18 ref. Western Reg. Research Proj W-68, USAEC Proj AT (451-1-1543).

Descriptors: *Soil density probes, *Soil moisture meters, *Nuclear moisture meters, *Bulk density, Gamma rays, Calibrations, Instrumentation, Nuclear meters, Soil density, Radioactivity techniques.

Soil bulk density and water content may be obtained concurrently through measurement of the attenuation of gamma photons from two different gamma ray sources and simultaneous solution of the resulting attenuation equations. Using gamma photons from Am-241 at 0.060 Mev and from Cs-137 at 0.662 Mev, attenuated in 10-cm soil columns, the standard deviation in both water content and bulk density measurements is primarily due to random emission and is about 0.007 g/cc for 1 million counts measured in air and about 0.005 g/cc for 2.5 million counts. However, as larger counts are used the precision of measurement of column thickness and soil and water attenuation coefficients becomes limiting. Maximum precision is about 0.0035 g/cc at midrange values of water content and bulk density. For narrow collimating slits the spatial resolution is only a little greater than slit thickness. (Knapp-USGS)
W72-10716

APPROXIMATION OF FIELD HYDRAULIC CONDUCTIVITY BY LABORATORY PROCEDURES ON INTACT CORES, California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.

M. H. Roulier, L. H. Stolzy, J. Letey, and L. V. Weeks.

Soil Science Society of America Proceedings, Vol 36, No 3, p 387-393, May-June 1972. 7 fig, 1 tab, 17 ref.

Descriptors: *Hydraulic conductivity, *Laboratory tests, *Soil water movement, Computer programs, Sampling, Cores, Unsteady flow, Soil moisture, Unsaturated flow.

Several laboratory procedures for approximating field values of unsaturated hydraulic conductivity over the suction range 30 to 100 cm of water were studied. Conductivity was measured in the laboratory on 10- by 30-cm intact cores by the transient flow (TF) method and was calculated by both the Marshall (M) equation and Millington and Quirk (M and Q) equation using moisture characteristic curves from laboratory measurements on intact cores and from the field data. The TF values were all higher than field values but, when used with a matching factor, they satisfactorily approximated field conductivities. The method of calculating the flow velocity influenced the results. The best results were obtained from a computer program which used a numerical differentiation subroutine. When used with matching factors, conductivities calculated by the M equation and M and Q equation were good approximations of field conductivity, though less satisfactory than results from the TF computer calculations. The best M and Q values were calculated from a field moisture characteristic while the M values were satisfactory when calculated either from the field moisture characteristic or from one measured in the laboratory on intact 6 by 10-cm cores. (Knapp-USGS)
W72-10717

CONTRIBUTIONS TO THE GENESIS AND CLASSIFICATION OF MARSH SOILS: III. CONTENTS, OXIDATION STATUS AND MECHANISMS OF BINDING OF SULFUR IN POLDER SOILS, (IN GERMAN), Kiel Univ. (West Germany). Institut fuer Pflanzenernaehrung und Bodenkunde.

G. Bruegger, H. S. Grunwaldt, and D. Schroeder. Z Pflanzenernaehr Bodenkd. Vol 129 No 2 p 92-108, 1971. Illus. (English summary).
Identifiers: Binding, *Classification, Marsh soils, Mechanisms, Metabolism, Oxidation, *Polder soils, *Sulfur.

The contents of total S and of various S fractions (total reduced S, monosulfide S, easily soluble SO4-S, SO4-S occluded in carbonates, absorbed SO4-S, SO4-S of low solubility, organically bound S) in various polder soils (Kalk-, Klei-, Knick- and Torf-marshes) were determined. After embankment has taken place, the high contents of total sulphur in muds and salt marshes decrease because of sulfide oxidation, release of S from decomposed organic matter with originally high S contents, and subsequent leaching of sulfates. Due to the change of environment in the A-horizon of polder soils, organic substances with lower content of S are formed. The organically bound S predominates and SO4 becomes the main anion in the soil solution after salts (mainly NaCl) are removed by leaching. SO4-S is found in the carbonates of Kalkmarshes. Adsorption of sulfates occurs below pH 6. Sulfate esters, organic Al-sulfate complexes and/or basic Al and Fe sulfates comprise the low-solubility sulfates. Under extremely acid conditions basic sulfates may form the predominant S fraction. In Klei-, Knick- and Torfmarshes (pH 2.5-6.5) the contents of sorbed and low-solubility sulfates and organic and total S increase considerably with decreasing pH- or increasing H-values. The influence of S metabolism on soil reaction and development of marsh soils is discussed. (Knapp-USGS)
W72-10718

SIMULTANEOUS TRANSPORT OF WATER AND SALT THROUGH CLAYS: 2. STEADY-STATE DISTRIBUTION OF PRESSURE AND

APPLICABILITY OF IRREVERSIBLE THERMODYNAMICS,
Hebrew Univ., Rehovoth (Israel). Faculty of Agriculture.
For primary bibliographic entry see Field 02K.
W72-10804

MOISTURE USE ESTIMATION AND RELATIONSHIP BETWEEN MOISTURE USE AND NITROGEN RESPONSE IN WINTER WHEAT, Kansas Water Resources Research Inst., Manhattan.

For primary bibliographic entry see Field 02D.
W72-10805

THE WATER BALANCE OF EPIGLEY SOILS, M. Gracanin.

Acta Bot Croat. Vol 29 p 131-147, 1970. Illus.
Identifiers: *Water balance, Clay, *Egley soils, Forests, Growth, Migration, Roots, Seasonal, Soils, Vegetation.

Root growth of the forest vegetation causes the formation of numerous cavities in the soil profile, and drying out of soil during dry periods produces cracks and crevices which facilitate the migration of clay particles from upper to deeper soil layers. This process hinders water seepage and leads to a periodic saturation of capillary and noncapillary cavities with water. The rise of ground water was impeded by the silting process with a resulting decrease in evaporation and hydromorphization of these soils. Only vegetation facilitates rapid upward movement of ground water which counteracts hydromorphization. These soils are dry in summer, moist in the spring and fall, and wet in winter. (Copyright 1972, Biological Abstracts, Inc.)
W72-10855

GUIDE TO THE DESCRIPTION OF TILL, Geological Survey of Canada, Ottawa (Ontario). J. S. Scott, and D. A. St-Onge.

Available from Geol. Survey of Canada, 601 Booth St, Ottawa, Price \$1.50. Canada Geological Survey Paper 68-6, 1971 (reprinted). 15 p, 5 fig, 16 ref, append.

Descriptors: *Till, *Glacial drift, Soil classification, Sedimentology, Canada, Sediments, Gravels, Sands, Sedimentary structures, Glaciers, Glaciation, Earth materials.

This manual outlines a standard method for describing the essential features of till. It is primarily intended for field use and therefore the procedures and measurements have been kept as simple as possible. However, a field description alone is not sufficient, and constantly appropriate laboratory tests are also listed. Till is a sediment of diverse texture and structure deposited by direct glacier action. The definition includes stratified material incorporated within till but excludes deposits derived primarily from glacial meltwater. No sharp distinction exists between till and stratified drift which may intergrade in some localities. Where such intergradation exists it is suggested that the general term 'glacial drift' be applied. The most outstanding characteristic of till is its lithologic and physical heterogeneity. It may be cohesive and compact or loose and friable depending upon its texture, mineral composition and post-depositional history. However, it is characteristically compact, poorly sorted, and unstratified. (Knapp-USGS)
W72-10907

CHEMICAL INDICATORS OF ARCTIC BIOLOGICAL AND ENVIRONMENTAL ACTIVITIES, Cold Regions Research and Engineering Lab., Hanover, N.H.

For primary bibliographic entry see Field 02I.

W72-10908

WATER CYCLE—Field 02

Water in Soils—Group 2G

SOILS OF THE CARIBOU-POKER CREEKS RESEARCH WATERSHED, INTERIOR ALASKA,

Soil Conservation Service, Palmer, Alaska.

S. Rieger, C. E. Furbush, D. E. Schoepfner, H. Summerfield, Jr., and L. C. Gieger.

Army Cold Regions Research and Engineering Laboratory Technical Report 236, April 1972. 11 p. 3 tab. append.

Descriptors: *Soil properties, *Cold regions, *Alaska, *Soil classification, *Soil water movement, Vegetation, Topography, Elevation, Permafrost, Hydrology, Soil profiles, Soil surveys, Water conservation.

Identifiers: *Caribou-Poker Creeks research watershed (Alaska).

Soils of the Caribou-Poker Creeks research watershed (41.5 sq mi), central Alaska, were mapped by standard Soil Conservation Service (USDA) methods. Seven soil series were recognized. Bradway silt loams, Ester silt loams, Karschner silt loams and Saulich silt loams, all underlain by permafrost at shallow depth, make up 27% of the basin area. Olnes silt loams, Gilmore silt loams and Fairplay silt loams, covering 73% of the watershed area, are free from permafrost. Areal distribution of soils is depicted on a photo-mosaic base at scale 1:31,680. (Woodard-USGS) W72-10911

PREDICTED DISTRIBUTION OF ORGANIC CHEMICALS IN SOLUTION AND ADSORBED AS A FUNCTION OF POSITION AND TIME FOR VARIOUS CHEMICAL AND SOIL PROPERTIES,

California Univ., Riverside. Dept. of Mathematics; and California Univ., Riverside. Dept. of Soils and Plant Nutrition.

For primary bibliographic entry see Field 05B. W72-10914

FIELD AND LABORATORY METHODS USED BY THE GEOLOGICAL SURVEY OF CANADA IN GEOCHEMICAL SURVEYS: NO. 11. URANIUM IN SOIL, STREAM SEDIMENT AND WATER,

Geological Survey of Canada, Ottawa (Ontario).

For primary bibliographic entry see Field 02K. W72-10917

CONTAMINATION OF THE SOIL WITH MERCURY,

European Atomic Energy Community, Petten (Netherlands). Joint Nuclear Research Center; and European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center; and Reactor Centrum Nederland, Petten.

For primary bibliographic entry see Field 05B. W72-10950

VARIATION IN THE PHYSICAL PROPERTIES OF SOLONETZES IN RELATION TO THE DOSE OF AMELIORANT,

N. P. Panov, G. I. Neretin, and A. I. Es'kov.

Dokl Mosk S-Kh Akad Im K A Timiryazev. Vol 154, p 111-116. 1969.

Identifiers: Aggregates, Ameliorants, Calcium, Crust, Dispersion, Dose, Formation, Hardness, Iron, *Solonetzes, Sulfates, *Soils, Soil physical properties.

The effect of Ca and Fe sulfates and K-4 polymer on the physical properties of chestnut solonetzes was studied. The ameliorants diminished crust formation, crust hardness and dispersity, increased the content of water-resistant aggregates and the infiltration rate. The ameliorant doses for low Na solonetzes may be based on the coagulation threshold of the high-dispersion fraction of illuvial horizons.—Copyright 1972, Biological Abstracts, Inc. W72-10991

MINERAL COMPOSITION OF GROUND- AND LYSIMETRIC WATERS OF CERTAIN ESTONIAN SOILS,

L. Reintam.

Sb Nauchn Tr Est S-Kh Akad. Vol 62, p 54-71. 1969. English summary.

Identifiers: Composition, Decalcification, Estonia, Groundwater, Lysimetric water, *Minerals, Soils, USSR, *Soil water.

Most of the groundwaters are neutral and rich in Ca and Mg. The Fe concentration decreases at higher hardness. Mineral concentrations decrease in spring and early summer and increase in autumn and winter. Vadose water is poorer in mineral elements. Lysimetric waters from the litter of rendzinas and brown soils are neutral, rich in Ca, K and N, while those from the litter of sod podzolic and brown pseudopodzolic soils are weakly acid and acid 'ferruginous.' The bulk of substances eluted from the litter are fixed in the underlying soil horizons (A1, B), but appreciable decalcification occurs in all cases.—Copyright 1972, Biological Abstracts, Inc. W72-10992

EFFECT OF SUBZERO TEMPERATURES ON THE EROSION-RESISTANCE OF SOIL IN RELATION TO ITS MOISTURE CONTENT,

N. A. Muromtsev.

Nauchn Tr Obninsk Otd Geogr Obsch SSSR. Vol 1, p 22-25. 1968.

Identifiers: *Soil erosion, *Soil moisture, Resistance, *Temperatures.

Resistance to erosion is unaffected by subzero temperatures at low moisture contents (oven-dry, air-dry, maximum hygroscopic); it is promoted at optimum saturation point, and impaired by capillary moisture.—Copyright 1972, Biological Abstracts, Inc. W72-10993

FORMS OF PHOSPHORUS IN A SEQUENCE OF SOILS DEVELOPED ON FRASER RIVER ALUVIUM,

Department of Agriculture, Agassiz (British Columbia). Research Station.

For primary bibliographic entry see Field 05B. W72-10994

EFFECT OF EXCESS MOISTURE ON CERTAIN PROPERTIES OF SOD PODZOLIC SOIL,

For primary bibliographic entry see Field 05B. W72-11001

THE WATER REGIME OF SANDY SOILS AND SHIFTING SANDS ON APSHERON,

K. Z. Amiraslanov.

Probl Osvoeniya Pustyn. Vol 1, p 76-81. 1970. English summary.

Identifiers: Apsheron, Arboreal-frutescent vegetation, *Sands, *Soil moisture, USSR.

The moisture content in the top 0-50 cm layer of the coastal sands varied from 0.5-2.0 to 8-10% over the year; it varied under arboreal-frutescent vegetation and on open areas (4-10%). The difference between the moisture contents of plowed and unplowed gray-brown sandy soil was insignificant. The mobility of these soils increased under autumn plowing.—Copyright 1972, Biological Abstracts, Inc. W72-11007

DESCRIPTION OF THE TYPES OF HUMUS PROFILE OF SEMI-HYDROMORPHIC FOREST SOILS IN THE LENINGRAD REGION,

O. G. Chertov.

Dokl Otd Komis Geogr O-Va SSSR. Vol 13, p 115-123. 1970. Translated from Ref Zh Otd Vyp Pochvoved Agrokhim, 1970, No. 6.57.189.

Identifiers: Humic acids, *Forest soils, Fulvic acids, *Humus, *Podzils, Leningrad, Nitrogen, USSR.

The humus content are higher in podzolic superficially gleyey and gley loamy soils than in podzolic soils of the automorphic series. The maximum humus content may reach 25%. The contents of humic acids in the soils are approximately the same, but the C:N ratio decreases from moist mor to moist mull soils. Mor soils are slightly higher in fulvic acids. N tends to concentrate in fulvic acids in the mor soils and in humic acids in the mull soils, with a fairly high concentration of N in the most stable compounds of the insoluble residue.—Copyright 1972, Biological Abstracts, Inc. W72-11010

INFLUENCE OF ALTERNATE FREEZING AND THAWING ON THE AVAILABILITY OF SOME SOIL MINERALS,

Department of Agriculture, Quebec.

B. T. Cheng, S. J. Bourget, and G. J. Ouellette.

Can J Soil Sci. Vol 51, No 3, p 323-328. 1971.

Identifiers: *Freeze-thaw tests, Availability, Elements, *Minerals, Moisture, Nutrients, Particles, Size, *Soils, Temperature.

Twenty-gram portions of Tilly soil of 3 particle sizes (less than 1.68 mm, less than 0.250 mm, and less than 0.149 mm) were placed in flasks and incubated for over periods of 1, 3 and 6 wk at water contents of 80 and 200% of field moisture capacity. They were either frozen and thawed once or repeatedly frozen and thawed. The recycling of freezing and thawing under flooded conditions increased the exchangeable Mg and Fe of the soil but decreased the amount of exchangeable Ca and K. Increasing the soil moisture content increased the availability of soil Mn and Fe. The solubility of K and Ca, however, was not affected by soil moisture. In all instances, the availability of certain soil minerals increased with decreasing soil particle size. Significant interaction between moisture level, particle size and freezing and thawing treatment on the mineralization of nutrient elements in the soil is also discussed.—Copyright 1972, Biological Abstracts, Inc. W72-11026

WATER MOVEMENT IN LAYERED SOILS: A SIMULATION MODEL,

Agricultural Univ., Wageningen (Netherlands). Dept. of Theor. Prod. Ecol.

H. Van Keulen, and C. G. E. M. Van Beek.

Neth J Agric Sci. Vol 19, No 3, p 138-153. 1971. Illus.

Identifiers: Hardpan, *Infiltration, Layered soils, *Model studies, Movement, Plowing, *Simulation analysis, *Soils.

A simulation model for infiltration of water in layered soils, written in CSMP (Continuous System Modeling Program), is described. The influence of the occurrence of a compacted layer or a loosened topsoil on the infiltration behavior is checked. This behavior can be predicted if soil parameters are available. An appendix emphasizes the problem of choosing the proper size of the compartments in which the soil is divided and the necessary averaging procedure. The magnitude of the time steps is discussed.—Copyright 1972, Biological Abstracts, Inc. W72-11029

THE EFFECT OF WATER:SOIL RATIOS ON QUANTITY AND CONCENTRATION OF ELEMENTS IN THE SOLUTION PHASE IN NON-SALINE SOILS AND ITS SIGNIFICANCE IN PLANT NUTRITION,

Soils and Irrigation Research Inst., Pretoria (South Africa).

E. Fischer.

Agrochemophysica. 2 (2): 41-42. Illus. 1970.

Identifiers: Concentration, Elements, Equilibrium, Non-saline, Nutrient, Nutrition, Phase, Plant, Quantity, Ratios, Soil, Soils, Solution, Water.

The quantities and concentrations of K in the solution phase at water:soil ratios of 16:1, 4:1 and 1:1 using 100 g of soil are given. The quantity of K in

Field 02—WATER CYCLE

Group 2G—Water in Soils

the solution phase is proportional to the square root of the water:soil ratio and the concentration on the other hand is proportional to the inverse of the square root of this ratio. This relationship observed for K was also found to be applicable for Ca and Mg. The data for quantity (Q) and concentration (C) and the water:soil ratio (R) may be expressed thus: Quantity $Q = BR^{1/2}$, and Concentration $C = B/R^{1/2}$ where B, B₁ are constants. Irrespective of the water:soil ratio (small or large) the quantity in the solution phase remains constant, but the concentration increases rapidly with decreasing water:soil ratios. In assessing nutrient status 2 considerations are of vital importance: an adequate equilibrium concentration of the essential nutrients in the soil solution, and the ability of the soil to sustain such an adequate concentration despite withdrawals by the plant and losses through leaching. Provided that equilibrium is reestablished at a sufficiently rapid rate, plant preference for certain ions can be automatically satisfied even if the equilibrium concentration is relatively low.—Copyright 1972, Biological Abstracts, Inc.

W72-11032

A STUDY OF THE EFFECTS OF SOIL MOISTURE STRESS AND FERTILITY LEVELS ON HYDROCYANIC ACID FORMATION IN SORGHUM,
Punjab Agricultural Univ., Hissar (India). Dept. of Soils.
For primary bibliographic entry see Field 03F.
W72-11046

EFFECTS OF TREATMENT PLANT EFFLUENT ON SOIL PROPERTIES,
Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 05D.
W72-11066

ESTIMATING STEADY-STATE EVAPORATION RATES FROM BARE SOILS UNDER CONDITIONS OF HIGH WATER TABLE,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02D.
W72-11079

2H. Lakes

DDT IN SURFACE WATERS, (IN GERMAN),
Hygiene-Institut, Schwerin (East Germany).
For primary bibliographic entry see Field 05C.
W72-10460

DEVELOPMENT OF A MODEL EDUCATIONAL PROGRAM TO IMPROVE ENVIRONMENTAL DECISION MAKING IN A LAKE WATERSHED - CANADARAGO LAKE, NEW YORK,
For primary bibliographic entry see Field 06B.
W72-10489

POWER PLANT SITING ON LAKE MICHIGAN,
Argonne National Lab., Ill.
For primary bibliographic entry see Field 06B.
W72-10492

MYALL LAKES--AN ANCIENT AND MODERN MONUMENT,
Sydney Univ. (Australia). School of Biological Sciences.
R. C. Carolin.
Ecological Society of Australia, Proceedings, Vol. 5, p 123-129, 1970. 5 fig.

Descriptors: *Geomorphology, *Dune sands, *Dune succession, *Plant groupings, Environmental effects, Vegetation effects, Mode of action, Ecological distribution, Social aspects, Australia. Identifiers: Myall Lakes (Australia).

About 30,000 years ago, in the Myall Lakes region, the sea level which had been rising for some time, reached a peak and began to recede. During the period of rise, beach instability together with sand blown inland resulted in the formation of a series of irregularly parabolic dunes. The falling sea-level left behind it a series of parallel dunes of low relief. The gradual fall in sea-level continued until about 17,000 B.P. after which the process reversed. The large parabolic dunes of the outer barrier system were clearly formed under a different climatic regime than the parallel dunes of the inner barrier system but many questions are raised about the history of the area which cannot at present be answered. The whole plant cover of the area also reflects much about its history. A description of the present vegetation is given and recognizable plant associations are traced. The sand dunes are considered a data-storage-retrieval system maintained today by a fine balance in the physical environment. At current levels of technical competence, much of this stored data cannot be retrieved and will be forever lost because of modern developments in the region. A plea is made for restraint in industrial activity. (See also W72-10531) (Casey-Arizona)

W72-10530

THE MYALL LAKES AND REGIONAL DEVELOPMENT,
Hunter Valley Research Foundation, Tighes Hill (Australia).
C. C. Renwick.
Ecological Society of Australia, Proceedings, Vol. 5, p 139-141, 1970. 1 fig.

Descriptors: *Resources development, *Land use, *Australia, *Lakes, *Water resources, Planning, Exploitation, Economic impact, Human resources.
Identifiers: Myall Lakes (Australia).

The Myall Lakes adjoin the eastern end of the East Coast Complex (ECC) and future pressures on the Myall Lakes resources can only be understood within the context of its total regional setting. The ECC consists of 4 distinct regions of New South Wales that are tightly interconnected by land and sea transport, employment and trade links. As a reflection of its population and economic importance, the ECC contains 2 major Australian rivers and their tributaries, 4 major ports, the major part of all power generation and use in the state, 30% of all jobs in Australia and much of the tourist industry. It is the nature of a resource to generate use-conflicts, and the multi-use resources engender much more conflict than do free goods, or those which have few alternative uses because of temporal or spatial limitations associated with them. The regions of rapid growth and consequent high resource use ultimately dictate the uses to which closely adjacent high-resource low-use areas will be put. A variety of possibilities concerning the exploitation of the Myall Lakes area by the ECC are outlined. (See also W72-10530) (Casey-Arizona)

W72-10531

TEMPERATURE PREDICTION IN STRATIFIED WATER: MATHEMATICAL MODEL-USER'S MANUAL.
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
For primary bibliographic entry see Field 05B.
W72-10547

A PHENOMENOLOGICAL RELATIONSHIP FOR PREDICTING THE SURFACE AREAS OF THERMAL PLUMES IN LAKES,
Argonne National Lab., Argonne, Ill. Center for Environmental Studies.
For primary bibliographic entry see Field 05B.
W72-10556

HEATED SURFACE JETS IN STEADY CROSS-CURRENT,
Federal Water Pollution Control Administration, Portland, Oreg., and Wisconsin Univ., Madison. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W72-10564

HEAT DISPERSEL-LAKE TRAWSFYNYDD COOLING STUDIES,
Central Electricity Generating Board (England). Northwestern Region.
For primary bibliographic entry see Field 05B.
W72-10569

BUFFALO LAKE PROJECT, RANDALL COUNTY, TEXAS.
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05B.
W72-10604

THE EFFECTS OF ARTIFICIAL AERATION ON LAKE ECOLOGY,
Michigan State Univ., East Lansing.
For primary bibliographic entry see Field 05C.
W72-10605

DISSOLVED AND PARTICULATE ORGANIC CARBON IN SOME COLORADO WATERS,
Colorado State Univ., Fort Collins. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W72-10606

NUTRIENT SOURCES FOR ALGAE AND THEIR CONTROL,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05C.
W72-10608

PESTICIDE INPUTS AND LEVELS: MINNESOTA WATERS-LAKE SUPERIOR BASIN.
Minnesota Pollution Control Agency, Minneapolis.
For primary bibliographic entry see Field 05C.
W72-10609

ACID MINE POLLUTION EFFECTS ON LAKE BIOLOGY,
Indiana Univ., Bloomington. Water Resources Research Center.
For primary bibliographic entry see Field 05C.
W72-10610

BOTTOM FAUNA IN THE TRESNA DAM RESERVOIR IN 1966,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
For primary bibliographic entry see Field 05C.
W72-10612

PLANKTONIC BLUE-GREEN ALGAE: GROWTH AND ODOR-PRODUCTION STUDIES,
North Texas State Univ., Denton. Dept. of Biological Sciences; and Teledyne Brown Engineers, Huntsville, Ala. and East Tennessee State Univ., Johnson City. Dept. of Biology.
For primary bibliographic entry see Field 05C.
W72-10613

POPULATIONS OF CLADOCERA AND COPEPODA IN DAM RESERVOIRS OF SOUTHERN POLAND,
Jagellonian Univ., Krakow (Poland). Dept. of Hydrobiology.
For primary bibliographic entry see Field 05C.
W72-10617

WATER CYCLE—Field 02

Lakes—Group 2H

ZOOPLANKTON OF THE DAM RESERVOIR
ON THE SOLA AT TRESNA IN THE FIRST
YEAR AFTER ITS CONSTRUCTION,
Polish Academy of Sciences, Krakow. Zaklad
Biologii Wod.
For primary bibliographic entry see Field 05C.
W72-10618

THE MICROBIOLOGICAL DECOMPOSITION
OF TRIBASIC CALCIUM PHOSPHATE IN THE
ILAWA LAKES,
Wyzsza Szkoła Rolnicza, Olsztyn-Kortowa (Poland). Katedra Mikrobiologii Technicznej.
For primary bibliographic entry see Field 05C.
W72-10620

THE PARTICIPATION OF SOME BACTERIA
IN THE SYNTHESIS OF VITAMIN B12 IN THE
WATER OF THE ILAWA LAKES,
Wyzsza Szkoła Rolnicza, Olsztyn-Kortowa (Poland). Katedra Mikrobiologii Technicznej.
For primary bibliographic entry see Field 05C.
W72-10621

A MICROBIOLOGICAL STUDY ON THE
HYPNEUSTON OF THE ILAWA LAKES IN
THE SUMMER SEASON,
Wyzsza Szkoła Rolnicza, Olsztyn-Kortowa (Poland). Katedra Mikrobiologii Technicznej.
For primary bibliographic entry see Field 05C.
W72-10622

MEDICAL LEECH OCCURRENCE AND
RESERVES IN THE LITHUANIAN SSR, (IN RUSSIAN),
Akademiya Nauk Litovskoi SSR, Vilnius. Institut
Zoologii i Parazitologii.
For primary bibliographic entry see Field 05C.
W72-10624

EUTROPHICATION ANALYSIS: A MULTIVARIATE APPROACH,
Environmental Health Center, Ottawa (Ontario).
For primary bibliographic entry see Field 05C.
W72-10627

EFFECT OF A TRAVELLING ATMOSPHERIC
PRESSURE DISTURBANCE ON A NARROW
LAKE WITH A DEPTH-DISCONTINUITY,
Department of the Environment, Ottawa (Ontario). Marine Sciences Branch.
T. S. Murty.
Manuscript Report Series No 23, 1971. 39 p, 16 fig, 4 ref.

Descriptors: *Water levels, *Lakes, *Atmospheric pressure, *Winds, Environmental effects, Analytical techniques, Mathematical models, Water level fluctuations, Waves (Water), Internal waves, Boundaries (Surfaces), Air-water interfaces, Stress, Boundary processes, Lake morphology.
Identifiers: Traveling atmospheric pressure.

The effect of a traveling atmospheric pressure disturbance on the water level of a narrow lake with a depth-discontinuity was studied using the method of characteristics. An atmospheric disturbance traveling over a body of water imparts energy to the water through pressure-gradient and wind-stress forces. The rate at which the water absorbs energy from the atmospheric disturbance depends upon how close the propagation speed of the disturbance is to the propagation speed of long gravity waves in the lake because resonant coupling is possible when they are equal or approximately so. Both semi-infinite stress-bands and finite stress-bands were considered. The setup defined as the difference in the water level between the right and left boundaries does not become periodic any time after the disturbance crosses the lake. For semi-infinite stress-bands the water level at the left side is predominantly negative while it is positive on the right side and it becomes both positive and negative for finite stress-band widths. (Woodard-USGS)

W72-10652

PROTOTYPE OBSERVATIONS OF SNETHAM PROJECT DIVERSION TUNNEL,
LONG LAKE, ALASKA,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W72-10663

POND CULTURE OF BAITS FISHES,
Colorado Cooperative Fishery Unit, Fort Collins. S. A. Flickinger.
Available from the National Technical Information Service as COM-72 10054, \$3.00 in paper copy, \$0.95 in microfiche. April 1, 1971 43 p.

Descriptors: *Aquaculture, *Minnows, *Economics, Surveys, Marketing, Ponds, Construction, Fishing, Diseases, Reproduction, Freshwater fish, Baits.
Identifiers: Bait fishes, *Pond culture.

Major considerations in the culture of the golden shiner and fathead minnow as bait fish are presented. Emphasis is upon economic considerations, pond construction, propagation techniques, feeding and harvesting.
W72-10696

DEVELOPMENT OF THE CAGE CULTURE
METHOD OF FISH PRODUCTION FOR COMMERCIAL USE IN LARGE RESERVOIR
LAKES,
State Coll. of Arkansas, Conway.
A. Collins.

Available from the National Technical Information Service as COM72-10056, \$3.00 in paper copy, \$0.95 in microfiche. Completion report, Aug 1971, 14 p., 1 fig., 3 tab. NMFS-4-67-D.

Descriptors: *Aquaculture, *Catfishes, Freshwater fish, Animal growth, Diets, Reservoirs, Fisheries, Fish farming, Fish management.
Identifiers: Fish cages, *Cage culture.

Four different cage designs ranging in volume from three to 12 cubic yards were each stocked with 300 fingerling catfish per cubic yard to determine the effects of the different cage sizes on growth and conversion of the fish. Fingerlings were graded to a uniform size before being stocked in an attempt to eliminate the differential growth. Results indicate that in large reservoir lakes the cage size can be unlimited in surface area and as deep as the water containing adequate dissolved oxygen. The depth of the cages had no important bearing on the growth rate and in the cages with the greater surface area the catfish grew more rapidly and converted food better. Differential growth of catfish in cages is a result of initial variance of the fingerling fish and not of hierarchy. Large numbers of wild fish around the cages caused problems of loss of food and possibly introduction of diseases. The wild fish can, however, be effectively trapped in the area of the cages. The economic evaluation indicated the following situations: a small scale operation incorporated into an existing business such as a marina and a very large scale operation (200,000 or more fish).
W72-10699

LIFE HISTORY AND ECOLOGY OF CARP,
CYPRINUS CARPIO LINNAEUS, IN
ELEPHANT BUTTE LAKE, NEW MEXICO,
New Mexico State Univ.

C. Sanchez.
Available from the National Technical Information Service as COM72-10028, \$3.00 in paper copy, \$0.95 in microfiche. Jan 1970, 78 p, 16 fig, 11 tab. NMFS-6-11-R.

Descriptors: *Carp, Life cycles, *Ecology, Food chains, Lakes, New Mexico, Population.
Identifiers: Elephant Butte Lake (N Mex), Cyprinus carpio.

Studies of life history and ecology of carp, *Cyprinus carpio Linnaeus*, were conducted from June 1964 through August 1969, in Elephant Butte Lake, New Mexico. Carp are the least abundant and constitute the smallest management problem of three rough-fish species. During the entire study 2,070 carp weighing 1,957.2 pounds were captured. It appears that considerable competition exists between carp, river carpsucker, and smallmouth buffalo. Density and biomass of carp have remained essentially unchanged while smallmouth buffalo have declined under commercial harvest and have been replaced by river carpsucker in shallow water.
W72-10701

EFFECTS OF COMMERCIAL FISHING ON
THE POPULATION OF SMALLMOUTH BUFFALO, *ICTIOPUS BUBALUS* (RAFINESQUE),
IN ELEPHANT BUTTE LAKE, NEW MEXICO,
New Mexico State Univ.

T. M. Moody.
Available from the National Technical Information Service as COM-72-10047, \$3.00 in paper copy, \$0.95 in microfiche. May 1970, 40 p., 3 fig, 11 tab, 21 ref. NMFS-6-11-R.

Descriptors: *Freshwater fishes, *Fishing, *New Mexico, Lakes, Life cycles, Resources, Ecology, Population, Commercial fish.

Identifiers: Elephant Butte Lake (N Mex), *Ictiobus bubalus*.

Studies were made on several parameters of the population of smallmouth buffalo in Elephant Butte Lake, New Mexico. Results are compared with similar studies made prior to April 1968, to determine influences caused by commercial removal of 95,640 fish weighing 383,639 pounds in 6 years. Population estimates made by use of the Schnabel Method, decline in the commercial catch, catch rates in experimental gill nets, changes in condition of fish, and decreases in relative density and biomass, all indicate that the buffalo population has been reduced. Comparison of age-growth studies, length-frequencies, weight-frequencies, and length-weight relationships shows increases in growth rates and improved condition resulting from reduction in intraspecific competition.
W72-10702

HURRICANE CAMILLE — EFFECT ON
STAGES IN ROSS BARNETT RESERVOIR,
MISSISSIPPI,
Geological Survey, Jackson, Miss.

K. V. Wilson.
Prof. Paper 800-B available from GPO, Washington, D C 20402 — Price \$2.25. In: Geological Survey Research 1972, Chapter B; U S Geological Survey Professional Paper 800-B, p B233-B254, 1972. 1 fig, 1 ref.

Descriptors: *Seiches, *Hurricanes, *Mississippi, *Reservoirs, Winds, Water level fluctuations, Tides, Lakes, Wind tides.

Identifiers: Ross Barnett Reservoir (Miss).

Hurricane Camille's winds tilted the surface of Ross Barnett Reservoir, Miss., as the storm center passed over the lake. At 8:00 a.m. on August 18, 1969, winds of 50 mph blowing directly downstream created stages of 298.0 feet at the gatehouse of the dam and 296.4 feet at State Highway 43. Between 8:00 and 9:00 a.m. the winds reversed and a large volume of water moved upstream. The inclination of the lake surface caused by the wind had a time lag in adjusting to changing wind direction. (Knapp-USGS)
W72-10738

GENERALIZATION OF WHITE'S METHOD OF
SUCCESSIVE APPROXIMATIONS TO
PERIODIC MARKOVIAN DECISION
PROCESSES,
Sun Oil Co., Dallas, Tex.

For primary bibliographic entry see Field 06A.
W72-10780

Field 02—WATER CYCLE

Group 2H—Lakes

LETHAL TEMPERATURES OF ROACH FRY (RUTILUS RUTILUS L.) FROM LAKES WITH NORMAL AND ARTIFICIALLY ELEVATED TEMPERATURE, Instytut Rybactwa Srodzialowego, Zabieniec (Poland). Dept. of Fish Culture. For primary bibliographic entry see Field 05C. W72-10786

THE CALEFACTION OF LAKE TRAWSFYNYDD, Liverpool Polytechnic (England). Dept. of Biology. For primary bibliographic entry see Field 05C. W72-10812

THE PLANKTON OF LAKE TRAWSFYNYDD, Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs. For primary bibliographic entry see Field 05C. W72-10813

AUTOTROPHIC AND HETEROTROPHIC NITRIFICATION IN AQUATIC SYSTEMS (LA NITRIFICATION AUTOTROPE ET HETEROTROPE DANS LES ECOSYSTEMES AQUATIQUES), Station d'Hydrobiologie Continentale, Biarritz (France). For primary bibliographic entry see Field 05C. W72-10858

MUTUAL RELATIONSHIPS OF MICROORGANISMS IN ILAWA LAKES WATERS, Wyższa Szkoła Rolnicza, Olsztyn-Kortowa (Poland). For primary bibliographic entry see Field 05C. W72-10860

CHEMICAL, BIOLOGICAL, AND PHYSICAL DATA FOR THE MAJOR LAKES AND RESERVOIRS IN LOUISIANA, Geological Survey, Baton Rouge, La. W. J. Shampine. Louisiana Department of Public Works Basic Records Report No 5, 1971. 98 p, 9 ref.

Descriptors: *Water quality, *Physicochemical properties, *Lakes, *Reservoirs, *Louisiana, Chemical analysis, Physical properties, Inorganic compounds, Biological properties, Inflow, Water temperature, Water levels, Hydrologic data, Data collections, Plankton, Dissolved oxygen, Specific conductivity.

Chemical, biological, and physical data for 40 of the major lakes and reservoirs in Louisiana are presented. These water bodies have a total of almost 1,900 square miles of surface area—about 80 percent of the total lake and reservoir surface area in Louisiana. For each lake or reservoir there is a map, a description of the physical setting, a general discussion of water quality, and selected basic data collected in the winter and the summer. The basic data include chemical analyses; plankton analyses; and depth profiles of dissolved oxygen, specific conductance, and temperature. (Woodard-USGS) W72-10915

REGULAR FORMATION PATTERNS OF TREMATODES OF BENTHIC INVERTEBRATES IN THE RESERVOIRS OF THE DNEIPER CASCADE (IN RUSSIAN), M. I. Chernogoreiko. Gidrobiol Zh., Vol 6, No 1, p 57-61, 1970, English summary.

Identifiers: Diplostomatidae, *Dnieper Cascade, *Invertebrates, Reservoirs, Schistosomatidae, Strigeidae, *Trematodes, USSR.

Population dynamics of the 3 most common trematode families in the Dnieper-Diplostomatidae,

Strigeidae and Schistosomatidae are discussed. Their role as parasites of benthic invertebrates and identification of some stages in their development are included.—Copyright 1972, Biological Abstracts, Inc. W72-10942

A METHOD TO STUDY THE HISTORY OF ANY PERSISTENT POLLUTION IN A LAKE BY THE CONCENTRATION OF CS-137 FROM FALLOUT, European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center. For primary bibliographic entry see Field 05B. W72-10953

HYDROBIOLOGICAL NOTES IN SHIMOKITA PENINSULA, WITH SPECIAL REGARD TO THE PLANKTON AND FISH DISTRIBUTION, (IN JAPANESE), Yamagata Univ. (Japan). Dept. of Biology. For primary bibliographic entry see Field 05C. W72-10989

LAKE FROGS, FISH AND WATER CRAYFISH AS POTENTIAL RETAINERS OF VIBRIOS IN NATURE, S. M. Mukhamedov, M. V. Inzhevavtova, A. F. Aleinikova, N. M. Ostrovskaya, and T. R. Radzhabov. Zh Mikrobiol Epidemiol Immunobiol. Vol 48, No 1, p 56-59. 1971. English summary.

Identifiers: Crayfish, Fish, Frogs, Retainers, *Vibrios, *Aquatic bacteria.

The role played by lake frogs, fish and water crayfish (the usual inhabitants of open water bodies of Uzbekistan) in the preservation of certain representatives of Vibrio genus in nature was studied. Irrespective of the season, from 8 to 15.5% of these animals were spontaneously infected with vibrios of various groups after Heiberg. No manifest signs of disease or any lesions were revealed in the organs of infected frogs and fish. Lake frogs, fish and crayfish probably served as reservoirs of vibrios in nature.—Copyright 1972, Biological Abstracts, Inc. W72-10998

LIMNOLOGICAL STATUS OF BIG SODA LAKE, NEVADA, OCTOBER 1970, Nevada Univ., Las Vegas. E. R. Koenig, J. R. Baker, L. J. Paulson, and R. W. Tew. Great Basin Nat. Vol 31, No 2, p 106-108. 1971. Identifiers: *Big Soda Lake (Nev), Chemocline, *Limnology, Nevada, Thermocline.

After 27 yr the thermocline in the mixolimnion of this meromictic lake remained 15-20 m below the surface and the chemocline shifted to 30-35 m below the surface. Considerable dilution has taken place since the earlier survey. Comparison between data of 1933 and 1970 are summarized.—Copyright 1972, Biological Abstracts, Inc. W72-11011

MICRO-HABITAT PH DIFFERENCES FROM THOSE OF THE SURROUNDING WATER, Virginia Polytechnic Inst., Blacksburg. Dept. of Biology. W. H. Yongue, Jr., and J. Cairns, Jr. Hydrobiologia, Vol 38, No 3/4, p 453-461, 1971, Illus. Identifiers: Habitat, *Microorganisms, *Hydrogen ion concentration, Water quality.

Polyurethane sponges were suspended in the surface waters of a Mecklenburg County, North Carolina pond that was posted and unused, a Cheboygan County, Michigan 'acid' bog pond and an 'alkaline' gravel-pit pond, and a Montgomery County, Virginia farm pond. The pH of the sponge water was often substantially different from that

of the surrounding water (e.g. sponge water pH 6.8, pond water pH 10.5). These differences are attributed to the microbial communities inhabiting the sponges. If this is generally true for microbial growths associated with substrates, the relationship of these species to the quality of the surrounding water should be re-examined.—Copyright 1972, Biological Abstracts, Inc. W72-11040

CHARA LAKES OF PROTECTIVE VALUE IN SOUTHERN NORWAY, Oslo Univ. (Norway). Botany Lab. A. Langangen. Blyttia. Vol 29, No 3, p 119-131. 1971. Illus. Map. English summary.

Identifiers: *Chara, Chara aculeolata, Chara aspera, Chara contraria, Chara globularis, Chara rufid, Chara strigosa, Chara tomentosa, Conservation, *Lakes, *Norway.

Altogether 31 Chara lakes were found in Southern Norway, and of these 8 were well preserved. Typical for these lakes are: C. tomentosa (new to Norway), C. aculeolata, C. contraria, C. rufid, C. strigosa (found with bulbils of C. aspera-type), C. aspera, and C. globularis. Protection is suggested for the 8 lakes described.—Copyright 1972, Biological Abstracts, Inc. W72-11069

2I. Water in Plants

COTTON: A COLLEGE OF AGRICULTURE REPORT, Arizona Univ., Tucson. Cooperative Extension Service; and Arizona Agricultural Experiment Station, Tucson. For primary bibliographic entry see Field 03F. W72-10518

LEAFLESS EUPHORBIAS ON RAJASTHAN (INDIA) ROCKS. IV. WATER RELATIONS OF SEEDLINGS AND ADULT PLANTS, Jodhpur Univ. (India). Dept. of Botany. For primary bibliographic entry see Field 03B. W72-10519

THE CONCEPT OF ECO-SYSTEM AS EXEMPLIFIED BY THE VEGETATION OF WESTERN RAJASTHAN, Central Arid Zone Research Inst., Jodhpur (India). S. K. Saxena. Vegetatio, Vol 24, No. 1-3, p 215-227, 1972. 19 ref.

Descriptors: *Ecosystems, *Biological communities, *Ecological distribution, *Arid lands, *Xerophytes, Soil moisture, Physiographic provinces, Plant groupings, Vegetation effects, Alluvium, Soil types, Climatic effects.

The term, ecosystem, has been applied to the physical factors forming the environment of the biome or the habitat factors in the widest sense. An effort was made to divide the desert vegetation of western Rajasthan into component physiographic ecosystems. Distribution of vegetation in the region is governed mainly by the soil texture and water-holding capacity, availability and quality of water, depth of the kankar pan, biotic influences and climate. Recent surveys indicate the region can be divided into the following ecosystems: (1) hills and rock outcrops; (2) piedmont zones; (3) alluvial plains; (4) saline flats and depressions; (5) graded river beds; (6) sand dunes; (7) aquatic areas. The vegetation of each ecosystem is discussed, particularly with respect to regional moisture and xeromorphic adaptations. (Casey-Arizona) W72-10522

WATER CYCLE—Field 02

Water in Plants—Group 21

PHYSOCOLOGICAL CHARACTERISTICS OF PERENNIAL ATRIPLEX DOMINATED VEGETATION OF SOUTHEASTERN UTAH, Utah State Univ., Logan. Dept. of Range Science; and Utah State Univ., Logan. Ecology Center. K. M. Ibrahim, N. E. West, and D. L. Goodwin. *Vegetatio*, Vol. 24, No. 1-3, p 13-22, 1972. 2 tab, 15 ref.

Descriptors: *Halophytes, *Arid lands, *Ecological distribution, *Plant groupings, On-site investigation, Utah. Shrubs, Biological communities, Saline soils, Ecosystems.

Identifiers: *Salt deserts, *Plant associations.

The Colorado Plateau is an important livestock wintering area and produces much unwanted sediment into reclamation developments on the Colorado River. As an early part of intensive ecological and hydrological evaluations of this area, an attempt was made to classify the various plant associations and clarify relationships that exist within each association. Four Atriplex associations of a salt desert area of southeastern Utah were identified by modified Zurich-Montpellier methodology. The species of highest fidelity generally possessed the highest values for cover, frequency and constancy. These species were: *Atriplex confertifolia*, *A. nuttallii*, *A. nuttallii* var. *gardneri* and *A. corrugata*. The phytosociological subdivisions have been used in subsequent hydrological investigations. (Casey-Arizona) W72-10524

ON THE CLIMATIC DETERMINATION OF SCALE SIZE IN A LIZARD, Washington Univ., Seattle. Dept. of Zoology. M. Soule, and W. C. Kerfoot. *Systematic Zoology*, Vol. 21, No. 1, p 97-105, March 1972. 4 fig, 4 tab, 19 ref.

Descriptors: *Xerophilic animals, *Reptiles, *Water balance, *Animal populations, *Climatic data, Temperature, Precipitation (Atmospheric), Evaporation, Evaporation pans, Arid lands, Regression analysis, Variability, Evolution, Ecological distribution.

Identifiers: *Thermoregulation.

The scales of reptiles are of paramount systematic utility. By studying the relations between climate and scale size in 2 northern populations of *Sceloporus graciosus*, an attempt was made to partition the phyletic and ecological contributions to the scale size in the eastern and western sections of the species. Data were gathered on temperature, precipitation and evaporation as well as topographic features. Multiple regression models were developed to analyze the effects of various factors on the scale size. In the western section of Idaho, northern Utah, western Wyoming and Nevada, where intense summer droughts are common, 84% of the geographic variation in the mid-dorsal scales was explained in August rainfall and annual pan evaporation, indicating that desiccation is probably the relevant selective factor. In the eastern section where summer rains are common, winter maximum temperatures and August rainfall account for 83% of the variation. Scale size may be an important component of both thermoregulatory and water balance systems by partially determining cutaneous surface area. This conclusion would militate against the concept that scale size is a neutral or nonadaptive character. (Casey-Arizona) W72-10529

GERMINATION BEHAVIOR OF A WEED AND THREE RELATED CROP PLANTS UNDER VARIOUS CONDITIONS OF SOIL WATER CONTENT AND TEMPERATURE, Shivaji Coll., New Delhi (India). Dept. of Botany. For primary bibliographic entry see Field 03F. W72-10534

ROOT SYSTEM OF TROPICAL TREES: 7. THE FACULTATIVE PEG-ROOTS OF ANTHOCLEISTA NOBILIS G. DON, Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav. J. Jenik.

Preslia (Praha), Vol 43, No 2, p 97-104, 1971. Illus. **Identifiers:** *Adaptation, Africa, Anthocleista liebrechtsiana D, Anthocleista nobilis D, Anthocleista vogelii D, Morphology, Peg roots, *Root systems, *Tropical trees, *Saturated soils.

Anthocleista nobilis (Loganiaceae), a common tree in ombrophilous forests of tropical Africa, develops both stilt roots and well-defined peg-roots in response to waterlogged soil and temporary flooding of the habitats. No root adaptations were found in specimens growing on normally drained ferrallitic soil. The peg-roots are facultative pneumatophorizae remaining, within a certain habitat, constant in size and shape. Smooth and rough types can be distinguished. Mature peg-roots are covered by suberized exodermis and/or by superficial periderm interrupted by numerous lenticels. The thick cortex contains large air spaces usual in similar kinds of pneumatophorizae of tropical trees. The radical and terminal growth of the peg-roots is strictly limited. Two closely related species, *A. vogelii* Planch. and *A. liebrechtsiana* De Wild. et Th. Dur. were found without any root adaptation to waterlogged ground.—Copyright 1972, Biological Abstracts, Inc. W72-10540

DAILY VARIATIONS OF THE ION CONTENT IN SALICORNIA EUROPaea DEPENDENT ON LOCATION AND OVERFLOODING, (IN GERMAN), Technische Hochschule, Darmstadt (West Germany). Botanisches Institut. For primary bibliographic entry see Field 02L. W72-10867

ANTITRANSPIRANTS-EFFECTS AND USES IN HORTICULTURE, California Univ., Davis. Dept. of Water Science and Engineering; and California Univ., Davis. Dept. of Pomology. For primary bibliographic entry see Field 03F. W72-10904

CHEMICAL INDICATORS OF ARCTIC BIOLOGICAL AND ENVIRONMENTAL ACTIVITIES, Cold Regions Research and Engineering Lab., Hanover, N.H. B. McCown, P. Coyne, J. Brown, and R. P. Murrmann.

Army Cold Regions Research and Engineering Laboratory Research Report 301, April 1972, 26 p, 4 fig, 4 tab, 3 ref, append. Contract DA Task 4A061101A91D03.

Descriptors: *Soil-water-plant relationships, *Cold regions, *Ecosystems, *Alaska, *Environmental effects, Tundra, Biochemistry, Carbon dioxide, Atmosphere, Soils, Biota, Freeze-thaw tests, Analytical techniques.

Identifiers: *Barrow (Alaska), Plant biomass.

The carbon cycling was studied by two methods in a cold-dominated ecosystem at Barrow, Alaska. One method involved a detailed analysis of the flow of CO₂ between the atmosphere, soil and biota, and the other method examined the internal carbon cycling in plants. The possibility of estimating underground plant biomass by biochemical means was investigated also. Both laboratory and field studies were conducted to analyze the input of CO₂ to the arctic atmosphere by frozen tundra soils. The frozen soil was a major source of CO₂. The CO₂ trapped in soils during bi-directional freezing in the fall and winter was released during the spring thaw, thus producing a spring rise in CO₂ content of the atmosphere. A procedure for the extraction and estimation of organic nutrients

(lipids and carbohydrates) was developed to follow the seasonal cycle of these nutrients of plants. No cycling in levels of carbohydrates (alcohol-soluble) was observed in the foliage during the season, however there was a definite cycling in lipid levels for all the species studied. Plant survival and organic nutrient levels were followed during the winter over a heated-soil experiment. The heating of the soil caused ponding which resulted in the elimination of *Dupontia fischeri* by mid-winter and the eventual death of all plants by spring. (Woodard-USGS) W72-10908

DIFFUSION RESISTANCES OF THE ADAXIAL AND ABAXIAL EPIDERMES OF KALE LEAVES IN A CONTROLLED ENVIRONMENT, Tehran Univ., Karaj (Iran). Faculty of Forestry. A. Djavanchir, and J. Catsky.

Photosynthetica, Vol 5, No 3, p 267-268, 1971. Illus.

Identifiers: Abaxial, Adaxial, *Diffusion, Environment, Epidermes, Kale-D, Leaves, Resistances, *Stomata.

The stomata in the abaxial leaf surface opened at a much lower irradiance than stomata on the adaxial leaf surface.—Copyright 1972, Biological Abstracts, Inc. W72-10937

RATE OF WATER OUTFLOW FROM CELLS OF FROST RESISTANCE PLANTS AT NEGATIVE TEMPERATURES (IN RUSSIAN), Akademiya Nauk SSSR, Moscow. Inst. of Plant Physiology.

O. A. Krasavtsev. *Fiziol Rast*, Vol 17, No 3, p 508-514, 1970, Illus. English summary.

Identifiers: Apple D, Birch D, Calorimeter, Cells, Ice formation, Frost, *Negative temperatures, Plants, Rates, Resistant.

The rate of flow of water from cells during extracellular formation of ice was measured by means of a Calvet-type calorimeter located in a low temperature cabinet. The measurements were carried out in several woody plant species in various ranges of negative temperature. Ice formation occurred at a lower rate in living branches than in branches preliminarily killed by steam. With lowering of the temperature, flow of water from the cells slowed down, but not very distinctly in a frost-resistant variety of birch. Super-cooled water can persist for a long time in living cells of an apple tree during freezing of the tree. Flow of water from cells is more rapid in plants subjected to natural or laboratory cold hardening. In 10 spp. of trees and shrubs a positive correlation is observed between the rate of cell dehydration and frost hardness. High frost resistance may be due to timely flow of water from the cells as a result of which the injurious formation of internal ice is avoided.—Copyright 1972, Biological Abstracts, Inc. W72-10943

AFGHANISTANI PLANT COMMUNITIES: II. THE MESOPHILIC AND HYDROPHILIC PLANT COMMUNITIES IN A SUMMER DROUGHT REGION, A. Gilli.

Vegetatio, Vol 23, No 3/4, p 199-234, 1971. English summary.

Identifiers: *Afghanistan, Drought, Hydrophilic plants, Mesophilic plants, Moisture, *Plant populations, Summer, *Aquatic plants.

In a region where transpiration amounts to about 7 times the average of precipitation per annum, mesophilic and hydrophilic plant communities are limited to habitats where either the ground is impenetrable to water and thus retains rainwater or where running water is present all the year round or where climatic factors supply a higher degree of moisture. Though such habitats are extremely

Field 02—WATER CYCLE

Group 21—Water in Plants

limited the number of different mesophilic or hydrophilic plant communities is rather high. Even in these communities, associations with typical character- or differential species are scarcely developed as the distance from one community to the next is often very great. Therefore seed dispersal is a matter of chance; also local differences in climate play an important part. Hydro-and xerophilic communities liable to occasional flooding in spring and to desiccation in summer are: *Cynodonotum dactylonitis*, *Juncetum Gerardi*, *Aeluropetum*, *Glaucetum maritimae* and *Cyperetum fuscii*. Almost permanently slightly submerged communities are: *Heleocharitetum uniglumis*, *Sparaganietum ramosi*, *Juncetum lampocarpri*, *Typhetum* and *Phragmitetum australis*. Among the communities that permanently need even a higher cover of water are: *Nasturtietum officinalis*, *Batrachieto-Zinnichellietum*, *Acoretum calami*, *Scirpetum maritimum*, *Potamogetonetum filiformis* and *Myriophylletum spicati*. The mesophilic communities are either shrubless and meadowlike such as: *Agrostidetum albae*, *Caricetum alpiniae*, *Poetum annuae*, *Trichophoretum pumilli*, *Plantaginetum gentianoidis*, or shrubs play a more important part as in the *Saliceto-Hippophaetum* and in the *Populeto-Arundinetum*, or they consist of high perennials as the *Heracleetum persici* and the *Ligularietum Thomsonii*, or they are growing in moist fissures of rocks as the *Adiantetum capilli Veneris*, *Oxyrietum digyna* and *Cortusetum himalaicae*.—Copyright 1972, Biological Abstracts, Inc.

W72-11019

CHANGES IN INDOLEACETIC ACID OXIDASE ACTIVITY ASSOCIATED WITH PLANT WATER POTENTIAL, Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research.

B. Darbyshire.

Physiol Plant. Vol 25, No 1, p 80-84. 1971. Illus.
Identifiers: *Lycopersicon esculentum* D, Oxidase, *Pisum sativum* D, *Plant water potential, *Indoleacetic acid, *Enzymes.

The effect of plant water potential on the activity of IAA oxidase was examined. With increasing plant water deficit the activity of IAA oxidase increased. Higher activities of this enzyme are known to be associated with older tissues and lower endogenous auxin levels. While water stress may adversely affect a variety of physiological processes, increases in the activity of IAA oxidase may provide plants with a drought adaptation mechanism. (The experimental plants were *Pisum sativum* and *Lycopersicon esculentum*).—Copyright 1972, Biological Abstracts, Inc.

W72-11022

THE CHARACTERISTICS OF LEAF ANATOMY AND DIFFUSION RESISTANCES, M. Rakhi.

Eesti Nsv Tead Akad Toim Biol. Vol 20, No 1, p 84-94. 1971. Illus. English summary.
Identifiers: *Diffusion, *Leaves, Resistance, Transpiration.

The estimation of diffusion resistance is discussed. The characteristics of leaf anatomy (volume of air space, percentage of the air volume, leaf thickness, internal exposed surface) of 20 species are presented. The stomatal (*rs*) and mesophyll (*rm*) diffusion resistances are calculated. Theoretical values are compared with experimental ones. The existence of optimal *rs* (from the point of view of maximum transpiration efficiency— $\text{mg CO}_2/\text{mg H}_2\text{O}$) in dependence of *rm* and cuticular resistance (*re*) is demonstrated. Optimal *rs* increases with decreasing *rm* and increasing *re*. Transpiration efficiency maintains its maximum value in the broader range of *rs* values when *re* is high.—Copyright 1972, Biological Abstracts, Inc.

W72-11023

SELECTIVE NUTRITION OF WATER ORGANISMS, (IN RUSSIAN), V. V. Sukhanov, and A. P. Shapiro.

Gidrobiol Zh. Vol 7, No 2, p 63-68. 1971. Illus. English summary.
Identifiers: *Nutrition, Organisms, *Predator-prey relationships.

On the basis of experiments made by Ivlev a model of the selective nutrition of a predator by an arbitrary number of preys is presented. Some features of the model are investigated. The example of the relationship between predator and the prey is analyzed.—Copyright 1972, Biological Abstracts, Inc.

W72-11036

NATURAL STANDS ON THE ALLUVIAL DEPOSITS OF UPPER OTAVA RIVER (IN CZECH), Zapadočeské Muzeum v Plzni (Czechoslovakia).

J. Sofron, and J. Stepan. Preslia (Praha), Vol 43, No 1, p 168-182. 1971, Illus. German summary.

Identifiers: *Alluvial deposits, *Alnus* D, *Baldinger arundinacea* M, *Czechoslovakia*, *Otava River*, *Petasites* D, *Phalaris* M, *Salix* D, Stands, Succession, *Plant populations.

The vegetation was studied by the methods of European phytocoenological school. The plant communities were found to belong to the associations *Petasito-Phalaridetum arundinaceae*, *Petasitetum hybridi*, *Salicetum purpureae*, *Alnetum incanae*. The nomenclature, distribution and ecology of these units were discussed. A succession series beginning with stands of *Baldinger arundinacea* and going through *Petasites* stands to association *Alnetum incanae* was recognized.—Copyright 1972, Biological Abstracts, Inc.

W72-11049

WATER-RETENTION CAPACITY AND HYDROPHILY OF GRAPEVINE COLLOIDS IN CONNECTION WITH FROST RESISTANCE (IN RUSSIAN),

Ukrainskii Nauchno-Issledovatel'skii Institut Vinogradarstva i Vinodeliya, Odessa (USSR). V. A. Sherer, G. M. Marieva, and S. E. Krasuk. Fiziol Biokhim Kul't Rast, Vol 3, No 2, p 180-183, 1971, Illus. English summary.

Identifiers: Capacity, Coagulation, Colloids, *Frost, *Grapevine-D, Hydrophily, Leaves, Resistance, *Water retention, Stems.

The study was made with frost-resistant and susceptible grape varieties. The water-holding capacity of the leaves and colloid hydrophily of the sprouts of frost-resistant varieties increased during the second half of vegetation. Under the effect of low temperatures, resistance of the colloid system to coagulation increased in frost-resistant varieties.—Copyright 1972, Biological Abstracts, Inc.

W72-11053

PRODUCTION AND FOOD CONSUMPTION OF PREDATORY FISH IN THE VISTULA RIVER, Instytut Rybactwa Srodoladowego, Zabieniec (Poland). Dept. of Fish Culture.

T. Bækkel. J Fish Biol. Vol 3, No 4, p 369-405. 1971. Illus.
Identifiers: Biomass, Food, Poland, *Predatory fish, Production, *Vistula River.

Vital statistics for 6 predatory fish species occurring in the Vistula River were estimated. The mixed, 6 spp. population, in its predatory phase, had an average biomass of 0.96 g/m² and produced 0.43 g/m². Less than 45% of annual production was exploited by man and eggs shed amounted to about 10% of the production. Annual consumption by the population amounted to about 3.44 kcal or g/m². Accuracy of all estimates is low.—Copyright 1972, Biological Abstracts, Inc.

W72-11071

2J. Erosion and Sedimentation

THE ORIGIN OF ACOUSTICALLY TURBED SEDIMENTS IN CHESAPEAKE BAY, Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.

For primary bibliographic entry see Field 02L.

SEDIMENT TRANSPORT-BED LOAD: GENERAL REPORT, Geological Survey, Fort Collins, Colo.

For primary bibliographic entry see Field 08B.

W72-10462

STATISTICALLY BASED DETERMINATION OF DEPTH AND WIDTH RATIOS IN ALLUVIAL WATERCOURSES, Florida Univ., Gainesville. Dept. of Civil Engineering.

For primary bibliographic entry see Field 08B.

W72-10463

A STATIONARY GAUSSIAN MODEL OF SAND WAVES,

Geological Survey, Fort Collins, Colo.

For primary bibliographic entry see Field 08B.

W72-10464

OCEANIC OVERWASH AND ITS ECOLOGICAL IMPLICATIONS ON THE OUTER BANKS OF NORTH CAROLINA, National Park Service, Washington, D.C. Office of Natural Science Studies.

For primary bibliographic entry see Field 02L.

W72-10632

POSTDEPOSITIONAL MOBILITY OF SOME TRANSITION ELEMENTS, PHOSPHORUS, URANIUM AND THORIUM IN DEEP SEA SEDIMENTS,

Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.

E. Bonatti, D. E. Fisher, O. Joensuu, and H. S. Rydell.

Geochemica et Cosmochimica Acta, Vol 35, No 2, p 189-201, February 1971. 5 fig, 3 tab, 26 ref.

Identifiers: *Sediments, *Pacific Ocean, *Elements (Chemical), *Geochemistry, *Deep water, Chemical reactions, Transmissivity, Phosphorus, Sampling, Chemical analysis, Analytical techniques.

Identifiers: Uranium, Thorium, Transition elements, Postdepositional mobility.

Deep sea hemipelagic sediments from the east Pacific show an oxidized upper zone of variable thickness and a reduced zone below. The geochemistry of a core from this region was studied in detail. The Eh of the upper zone is close to +100 mV, while in the lower zone it reaches about -400 mV. Reducing conditions in the lower section of the core are related to the oxidation of organic matter in the sediment, as indicated by the gradual decrease with depth of the concentration of nitrogen in the upper part of the core. Various elements, such as Mn, Ni, Co, P and La, are enriched in the upper oxidized zone, while Cr, V, U and S are enriched in the lower reduced zone. Post-depositional mobility of the elements, mainly by diffusion in the interstitial solutions, can explain their distribution in the core. Redox reactions can account directly for the mobilization of Mn, Ni, Co, Cr, V and U, indirectly for that of P and La. Fe and Cu do not migrate significantly, since they are immobilized as sulfides in the reduced zone. Th appears not to be affected by diagenetic mobility. (Woodard-USGS)

W72-10635

WATER CYCLE—Field 02

Erosion and Sedimentation—Group 2J

FATTY ACID-CLAY MINERAL ASSOCIATION IN ARTIFICIAL AND NATURAL SEA WATER SOLUTIONS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 05A.
W72-10638

MOUTERE, IHD EXPERIMENTAL BASIN NO. 8, 1970.
For primary bibliographic entry see Field 04C.
W72-10653

ENGINEERING METHODS OF CALCULATING AND FORECASTING WATER EROSION (INZHENERNYE METODY RASCHETA I PROGNOZA VODNOY EROZII),
Ts. Ye. Mirtakulova.
'Kolos', Moscow, 1970. 240 p.

Descriptors: *Erosion, *Soil erosion, *Erosion rates, *Erosion control, Hydraulic engineering, Soil physical properties, *Soil structure, Particle size, Gully erosion, Channel erosion, Scour, Velocity, Runoff, Raindrops, Impact (Rainfall), Slopes, Vegetation, Meteorology, Forecasting, Computers.

Identifiers: *USSR, *Hillslope erosion, Natural erosion, Erodibility, Soil losses.

The mechanics of erosion processes and the factors which control the rate of erosion by water are examined. Particular attention is given to engineering methods for calculating and forecasting erosional processes to protect soil from water erosion. Techniques are presented for determining critical runoff velocities influencing rates of erosion and for forecasting erosion produced by raindrop impact. Practical hydraulic measures for reducing erosion are discussed in terms of increasing the stability of soil structure. (Josefson-USGS)
W72-10655

234U/238U AS A TOOL FOR DATING MARINE SEDIMENTS,
Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
T. M. Krishnamoorthy, V. N. Sastry, and T. P. Sarma.
Current Science (India). Vol 40, No 11, p 279-281, June 5, 1971, 2 fig, 12 ref.

Descriptors: *Sedimentation, *Sedimentary petrology, *Marine geology, *Indian Ocean, *Dating, Radioactive dating, Geologic history, Calcium carbonate, Uranium, Leachate.

A method for dating marine sediments using the decrease of 234U/238U activity ratio in the calcium carbonate phase was developed. A selective leaching agent NH4Ac-HAc buffer was used which attacks only the calcium carbonate phase and very little of the other phases. The rate of sedimentation for the core, M-230 (Lat. 23 deg. 10 min. N, Long. 67 deg. 50 min E) from Indian Ocean was 1.16 mm/1,000 yrs by this method. The calculated ionium value for the particular water column depth and for the typical composition of the top layer of the sediment was 1.58 dpm/g and agrees very well with the actual value of 1.28 dpm/g observed, considering the uncertainties in the parameters used. (Houser-ORNL)
W72-10675

FISSION TRACK DATING OF VOLCANIC GLASS SHARDS IN MARINE SEDIMENTS,
Scripps Institution of Oceanography, La Jolla, Calif. Geological Research Div.

D. MacDougall.
Earth and Planetary Science Letters, Vol 10, March 1971, p 403-406. 2 tab, 12 ref.

Descriptors: *Sedimentation, *Sedimentary petrology, *Marine geology, *Dating, *Radioactive dating, *Age, Geological history, Deposition (Sediments), Sands, Soils, Sediments, Oceans.

Identifiers: Glass shards, Ash.

The fission track dating method can be used for at least one component of deep sea sediments: glass shards from volcanic ash layers. The ages determined for three selected samples are identical in each case, within experimental errors, to those previously determined by two other methods. Improvements in sample preparation and the use of the fluoroboric-nitric-acetic acid etchant made it possible to apply the fission track dating method to the small sized, irregular shaped glass shards. Since such shards are rather common constituents of deep sea sediments, this work points to a reliable and quite generally applicable new method for dating deep sea sediments. Two particular advantages which the fission track method holds over the potassium-argon method are that (i) much smaller samples suffice and (ii) since shards are examined one-by-one microscopically, contaminants can be easily distinguished and discarded. (Houser-ORNL)
W72-10692

SOME IMPORTANT INORGANIC NITROGEN AND PHOSPHORUS SPECIES IN GEORGIA SALT MARSH,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
For primary bibliographic entry see Field 02K.
W72-10706

SEDIMENT YIELDS OF URBAN CONSTRUCTION SOURCES, MONTGOMERY COUNTY, MARYLAND,
Geological Survey, Parkville, Md.
T. H. Yorke, and W. J. Davis.
Geological Survey Open-file Report, 1972. 39 p, 16 fig, 8 tab, 15 ref, append.

Descriptors: *Sediment yield, *Urban hydrology, *Urbanization, *Maryland, Urban runoff, Storm runoff, Erosion, Construction, Sedimentation, Regression analysis, Discharge (Water), Water yield, Sediment control, Erosion control.
Identifiers: Rock Creek basin (Md), Anacostia basin (Md), *Montgomery County (Md).

In three urbanizing streams in the Rock Creek-Anacostia River basin, Md, sediment load increases significantly as urban construction increases. In Bel Pre Creek, suspended-sediment discharge increased 14-fold as a result of urban construction on about 15 percent of the basin, during the first 30-month period of the study. Sediment-water discharge curves and graphic regression analysis indicate that a direct relation exists between the sediment yield of a basin and the area of land under construction, the season of year, slope of land at construction sites, and proximity of construction sites to stream channels. (Knapp-USGS)
W72-10719

SEDIMENT CONTROL METHODS: B. STREAM CHANNELS.
American Society of Civil Engineers, New York. Hydraulics Div.
For primary bibliographic entry see Field 08B.
W72-10722

METHOD AND MEANS FOR PLACING ARTIFICIAL SEAWEED,
For primary bibliographic entry see Field 04D.
W72-10769

THE EFFECTS OF SUSPENDED SILTS AND CLAYS ON SELF-PURIFICATION IN NATURAL WATERS: PROTEIN ADSORPTION,
Alaska Univ., College. Inst. of Water Resources.
For primary bibliographic entry see Field 05C.
W72-10808

RAPID METHOD FOR IDENTIFYING ALDRIN IN THE PRESENCE OF SULFUR BY ELECTRON CAPTURE GAS CHROMATOGRAPHY,
Northeast Louisiana Univ., Monroe.
For primary bibliographic entry see Field 05A.
W72-10881

FIELD AND LABORATORY METHODS USED BY THE GEOLOGICAL SURVEY OF CANADA IN GEOCHEMICAL SURVEYS: NO. 11. URANIUM IN SOIL, STREAM SEDIMENT AND WATER,
Geological Survey of Canada, Ottawa (Ontario).
For primary bibliographic entry see Field 02K.
W72-10917

ORIGINS OF DEEP-SEA SEDIMENTS AND THEIR VARIATIONS WITH TIME. ANNUAL PROGRESS REPORT NO. 3,
Columbia Univ., Palisades, N.Y. Lamont-Doherty Geological Observatory.
P. E. Biscaye.

Available from NTIS as CU-3132-3, \$3.00 in paper copy, \$0.95 microfiche. Report No. CU-3132-3, September 1971. 176 p, 77 ref. AT (30-1)-4055.

Descriptors: *Geologic time, *Sedimentation, *Bottom sediments, *Oceans, Atlantic Ocean, Pacific Ocean, Pleistocene epoch, Recent epoch, Oceanography, Deep water, Suspended solids, Particle size, Lead, Strontium, Air pollution, Mixing, Mineralogy, Antarctic Ocean, Cores, Geochemistry, Tracking techniques, Tracers, Stable isotopes.

Identifiers: Argentine Basin, Brazil Basin, Eastern Rio Grande Rise, Indian Ocean, Mediterranean Sea, Rio de la Plata Estuary, East Pacific Rise, Caribbean Sea.

Distribution and origin of deep-sea sediments were studied by: (1) the Rb-Sr tracer system, (2) fine-fraction mineralogy, (3) excess RN in suspensions and bottom profiles, and (4) other techniques. A study using natural Pb-212 in the atmosphere measured vertical mixing in a fluid medium. Reports or summaries detail 18 projects following a general introduction. (Bopp-ORNL)
W72-10980

EFFECT OF SUBZERO TEMPERATURES ON THE EROSION-RESISTANCE OF SOIL IN RELATION TO ITS MOISTURE CONTENT,
For primary bibliographic entry see Field 02G.
W72-10993

BUDGET OF CALCIUM CARBONATE, SOUTHERN CALIFORNIA CONTINENTAL BORDERLAND,
Hawaii Inst. of Geophysics, Honolulu.
For primary bibliographic entry see Field 02K.
W72-11031

OUTLET WEIRS FOR TRAPEZOIDAL GRIT CHAMBERS,
Indian Inst. of Science, Bangalore.
For primary bibliographic entry see Field 05D.
W72-11054

POTENTIAL TRANSPORT OF SEDIMENT FROM ENLOE RESERVOIR BY THE SIMIL-KAMEEN AND OKANOGAM RIVERS, WASHINGTON,
Geological Survey, Tacoma, Wash.
L. M. Nelson.
Geological Survey Open-file Report, 1972. 21 p, 8 fig, 1 tab, 4 ref.

Descriptors: *Sediment transport, *Streams, *Reservoirs, *Sediment yield, *Washington, Dams, Forecasting, Data collections, Flow measurement, Streamflow, Sedimentation, Hydrologic data, Data collections.

Field 02—WATER CYCLE

Group 2J—Erosion and Sedimentation

Identifiers: *Similkameen River (Wash), *Okanogan River (Wash), *Enloe Dam (Wash), Dam removal.

This study was undertaken to determine the probable effects on the Similkameen and Okanogan Rivers of the removal, transport, and deposition of sediment now deposited behind Enloe Dam on the Similkameen River, Washington, if the dam were removed. Under existing conditions of sediment transport, the average annual suspended-sediment discharges at three streamflow-measuring sites were calculated to be 134,000 tons for the Similkameen River near Nighthawk, 175,000 tons for the Okanogan River near Tonasket, and 175,000 tons for the Okanogan River at Malott. The volume of sediment in Enloe Reservoir was computed to be about 2.4 million tons. The sediment is largely sand. If the dam were removed the maximum amount of reservoir sand transportable (in addition to normal sediment discharge), under stated conditions of velocity and depth during any average 10-year period, would range from about 17,000 to 580,000 cubic yards per year, with about 320,000 cubic yards being transported during a year of average water discharge. These volumes represent a range of 32 to less than 1 percent of the volume of sediment now deposited in the reservoir. (Woodard-USGS)
W72-11088

2K. Chemical Processes

GROUNDWATER OF SIBERIA AND THE SOVIET FAR EAST (PODZEMNYYE VODY SIBIRI I DAL'NEGO VOSTOKA).
For primary bibliographic entry see Field 04B.
W72-10440

MINERAL WATERS IN THE NORTHWESTERN PART OF THE KANSK ARTESIAN BASIN (MINERAL'NYYE VODY SEVERO-ZAPADNOY CHASTI KANSKOGO ARTEZIANSKOGO BASSEYNA),
For primary bibliographic entry see Field 02F.
W72-10447

FORMATION OF THE CHEMICAL COMPOSITION OF WATERS OF SOME MINERAL SPRINGS IN EASTERN SAYAN (O FORMIROVANIY KHIMICHESKOGO SOSTAVA VOD NEKOTORYKH MINERAL'NYKH ISTOCHNIKOV VOSTOCHNOGO SAYANA),
Irkutskii Gosudarstvennyi Universitet (USSR).
For primary bibliographic entry see Field 02F.
W72-10448

MINERAL WATERS OF THE CHITA OBLAST (MINERAL'NYYE VODY CHITINSKOY OBLASTI),
Chitinskoe Geologicheskoe Upravlenie (USSR).
For primary bibliographic entry see Field 02F.
W72-10449

POSTDEPOSITIONAL MOBILITY OF SOME TRANSITION ELEMENTS, PHOSPHORUS, URANIUM AND THORIUM IN DEEP SEA SEDIMENTS,
Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
For primary bibliographic entry see Field 02J.
W72-10635

STUDY OF THE BEHAVIOR OF DISSOLVED SILICA IN THE ESTUARY OF THE SCHELDT, Brussels Univ. (Belgium).
For primary bibliographic entry see Field 02L.
W72-10636

SAND-SEAWATER INTERACTIONS IN BERMUDA BEACHES, Oregon State Univ., Corvallis. Dept. of Oceanography.
For primary bibliographic entry see Field 02G.
W72-10637

FATTY ACID-CLAY MINERAL ASSOCIATION IN ARTIFICIAL AND NATURAL SEA WATER SOLUTIONS, Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 05A.
W72-10638

INFRARED SPECTRA OF HUMIC ACIDS AND RELATED SUBSTANCES, Illinois Univ., Urbana. Dept. of Agronomy.
For primary bibliographic entry see Field 05A.
W72-10640

KINETICS OF MASS TRANSFER AMONG SILICATES AND AQUEOUS SOLUTIONS, California Univ., Berkeley. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 01B.
W72-10641

GEOCHEMISTRY AND ORIGIN OF FORMATION WATERS IN THE WESTERN CANADA SEDIMENTARY BASIN-III. FACTORS CONTROLLING CHEMICAL COMPOSITION, Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 02F.
W72-10642

WATER RESOURCES AT MARINE CORPS SUPPLY CENTER, BARSTOW, CALIFORNIA FOR THE 1971 FISCAL YEAR, Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 04B.
W72-10645

SOME IMPORTANT INORGANIC NITROGEN AND PHOSPHORUS SPECIES IN GEORGIA SALT MARSH, Georgia Inst. of Tech., Atlanta. Environmental Resources Center.

P. R. Maye, III.
Available from NTIS as PB-210 713, \$3.00 in paper copy, \$0.95 in microfiche. Georgia Environmental Resources Center, Report ERC-0272, May 1972. 60 p., 10 fig, 13 tab, 40 ref. OWRR B-033-GA (1).

Descriptors: *Ammonium compounds, *Phosphorus compounds, *Inorganic compounds, *Nitrogen compounds, *Salt marshes, Clay minerals, Chemical processes, Water chemistry, Cation exchange, Cation adsorption, Marsh plants, Chelation, Salinity, *Georgia.
Identifiers: *Savannah River Basin, *Ogeechee River Basin, Southeastern U. S.

The objective was to determine how and to what extent the chemistry of fresh and saline waters is controlled by clay minerals and associated organic matter. Core samples were taken in the marshes of the Savannah River and Ogeechee River basins in Southeastern Georgia. Sediments and interstitial waters from the cores were analyzed for inorganic nitrogen and phosphorus species. The interstitial waters contained ammonium and phosphate in varying concentrations which in general increased with core depth. Exchangeable and nonexchangeable ammonium were found in the marsh sediments. Fixed ammonium averaged about five times the amount of exchangeable ammonium. Both the exchangeable and fixed ammonium present in the sediment were dependent on the amount of clay present. Inorganic phosphorus species were found in the marsh sediments in varying amounts. Grain size and salinity appear to influence the relative amounts of phosphate species present in any given sample. (Conway-Georgia)

W72-10706

CHEMICAL CHARACTERIZATION OF DISSOLVED ORGANIC MATTER AND ITS INFLUENCE ON THE CHEMISTRY OF RIVER WATER, Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
J. H. Reuter, and E. M. Perdue.
Available from NTIS as PB-210 714, \$3.00 in paper copy, \$0.95 in microfiche. Georgia Environmental Resources Center, Report ERC-0372, May 1972. 33 p., 3 fig, 5 tab, 23 ref. OWRR A-026-GA (1).

Descriptors: *Fulvic acids, *Humic acids, *Organic matter, Water chemistry, *Inorganic compounds, Ion exchange, Polymers, Organic acids, Chelation, Adsorption, Chemical reactions, Amino acids, River systems, *Georgia.
Identifiers: *Satilla River, Southeastern U. S.

River waters in Southeastern U. S. are rich in dark brown organic matter which resembles soil fulvic acids in both appearance and chemical characteristics. River water organic matter was obtained by freeze-drying river water and by fractionating it by gel permeation chromatography (GPC). Analysis of oxygen-containing functional groups in both total river water organic matter and its GPC fractions shows a high total acidity (12.4 meq/g). The ratio of carboxyl to phenolic hydroxyl ranges from 3:1 for the low molecular weight fraction to about 1:1 for the high molecular weight fraction. Both IR and NMR spectra of river water organic matter are comparable to those of soil fulvic acids. Amino acids chemically incorporated in river water organic matter amount to about 4.4 percent. River water organic matter can be understood as a composite of polymeric compounds of an intermediate oxidation state which possess a longer mean half-life than the original biogenic precursors from which they were formed. The influence of humic compounds on the chemistry of river waters, as in this case, may be expected to occur in any surface water, i.e. donation of acidic protons, complexation and chelation of metals, determination of equilibrium of inorganic carbon species, reaction with dissolved oxygen. The degree of this chemical influence depends not so much on the absolute amount of river water organic matter as on the organic-inorganic matter ratio. (Conway-Georgia)
W72-10707

SOLUBILITY OF SILICA IN SOILS, Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W72-10709

ION MOBILITIES AND ELECTRIC CHARGE OF EXTERNAL CLAY SURFACES INFERRED FROM POTENTIAL DIFFERENCES AND OSMOTIC FLOW, Agricultural Research Service, Beltsville, Md. Soils Lab.
For primary bibliographic entry see Field 02G.
W72-10710

CLAY-WATER INTERACTION, THE BEHAVIOR OF H-3 AND H-2 IN ABSORBED WATER, AND THE ISOTOPE EFFECT, Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
G. L. Stewart.
Soil Science Society of America Proceedings, Vol 36, No 3, p 421-426, May-June 1972. 2 tab, 12 ref.

Descriptors: *Isotope fractionation, *Adsorption, *Clay minerals, *Soil water movement, *Tracers, Tagging, Radioisotopes, Deuterium, Tritium, Stable isotopes, Kaolinite, Isotope studies.
Identifiers: *Clay-water interactions.

Reference clay minerals and a field kaolinitic soil were allowed to equilibrate with water tagged with tritium and deuterium. Ratios of tritium and deu-

WATER CYCLE—Field 02

Estuaries—Group 2L

terium concentrations of tenaciously adsorbed water to respective concentrations of bulk pore water were approximately equal to one for all soils and clay minerals tested. This suggests that no significant isotopic fractionation occurs in adsorbed water. Thermodynamic theory, relating isotopic fractionation to the energetics of adsorbed water, also predicts that isotopic fractionation is not a function of the energy status of adsorbed water. Data from another experiment, where oven-dry samples equilibrated with water vapor in a controlled atmosphere, showed that tenaciously adsorbed water on kaolinite mineral surfaces is not as liable to exchange with the vapor phase as was adsorbed water on montmorillonite and illite surfaces. (Knapp-USGS)

W72-10711

UNUSUAL TEMPERATURE VARIATIONS IN TWO SMALL STREAMS IN NORTHERN VIRGINIA.

Geological Survey, Arlington, Va.

For primary bibliographic entry see Field 02E.
W72-10739

SIMULTANEOUS TRANSPORT OF WATER AND SALT THROUGH CLAYS: 2. STEADY-STATE DISTRIBUTION OF PRESSURE AND APPLICABILITY OF IRREVERSIBLE THERMODYNAMICS,

Hebrew Univ., Rehovot (Israel). Faculty of Agriculture.

A. Benin, and P. F. Low.

Soil Sci. Vol 112, No 2, p 69-88. 1971. Illus.

Identifiers: *Clays, Conductance, Conductivity, Diffusion, Distribution, Flow, Osmosis, Pressure, *Salt, Thermodynamics, Transference, *Water transport.

Osmosis through a clay paste was studied. Measurements were made of the following quantities at each of 5 locations within the paste: transference numbers of Na⁺ and Cl⁻; specific conductance; water tension; activities of Na⁺, Cl⁻, NaCl and water; swelling pressure; and concentrations of Na⁺, Cl⁻, and clay. The mobilities of Na⁺ and Cl⁻ were calculated from their respective transference numbers and the specific conductances. The relative partial molar free energies of Na⁺, Cl⁻, NaCl and water were calculated from their activities. The hydraulic conductivities of the paste at the different locations were estimated from curves of hydraulic conductivity versus clay concentration at different salt concentrations. The observed water flux far exceeded that which would result from diffusion alone. The observed NaCl flux was approximately equal to the calculated diffusive flux. The water transfer was by viscous or laminar flow, whereas the salt transfer was by diffusion. Since the partial molar free energy of the water decreased nearly linearly through the paste from the less concentrated to the more concentrated solution, it was likely the driving force.—Copyright 1972, Biological Abstracts, Inc.

W72-10804

HYDROLOGIC RECONNAISSANCE OF THE BLUE CREEK VALLEY AREA, BOX ELDER COUNTY, UTAH.

Geological Survey, Salt Lake City, Utah.

For primary bibliographic entry see Field 04B.
W72-10900

ANALYSIS OF THE MAJOR CATIONIC CONSTITUENTS OF THE 1964 TO 1969 SNOW ACCUMULATIONS AT DYE SITES 2 AND 3, GREENLAND,

Cold Regions Research and Engineering Lab., Hanover, N. H.

S. E. Ragone, and C. A. Wolf.

Army Cold Regions Research and Engineering Laboratory Special Report 169, April 1972. 9 p, 1 fig, 5 tab, 7 ref. NSF Grants: AG 104 and AG 212.

Descriptors: *Sampling, *Snow, *Glaciers, *Cations, Fallout, Air pollution, Variability, Sodium, Potassium, Calcium, Magnesium, Iron. Identifiers: *Greenland.

The Na, K, Ca, Mg and Fe concentrations in the 1964 to 1969 annual snow accumulations at two sites on the Greenland Ice Cap were measured. Although the concentrations of most of these cations showed significant variations on an annual and seasonal basis, no clear-cut trend or relationship between these parameters and the concentrations was observed. (Knapp-USGS)

W72-10910

FIELD AND LABORATORY METHODS USED BY THE GEOLOGICAL SURVEY OF CANADA IN GEOCHEMICAL SURVEYS: NO. 11. URANIUM IN SOIL, STREAM SEDIMENT AND WATER,

Geological Survey of Canada, Ottawa (Ontario).

A. Y. Smith, and J. J. Lynch.

Available from Geol. Survey of Canada, 601 Booth St., Ottawa. Price \$0.75. Canada Geological Survey Paper 69-40, 1969. 9 p, 2 tab, 8 ref.

Descriptors: *Laboratory tests, *Uranium radioisotopes, *Chemical analysis, *Water analysis, *Soil analysis, Exploration, Geochemistry, Fluorometry.

Identifiers: *Geochemical surveys, *Geochemical prospecting.

Analytical methods used in Canada to determine trace quantities of uranium in soil, stream sediment and water are described. These techniques have been tested and used successfully in mobile field laboratories as well as in the headquarters laboratory. The method for analysis of uranium is based on procedures in use by the United States Geological Survey and developed by them for the United States Atomic Energy Commission. This method is based on the fact that uranium salts fluoresce in the presence of sodium fluoride. In practice uranium salts are fused with a flux containing sodium fluoride and when the resulting melt is exposed to ultraviolet radiation, a fluorescence is produced, the intensity of which is proportional to the concentration of uranium present. With careful attention to detail, these procedures are capable of excellent sensitivity and satisfactory precision. For water samples the practical limit of sensitivity is 0.2 part per billion, while for soils and stream sediment samples, the limit is 0.5 part per million. (Knapp-USGS)

W72-10917

ANALYSIS OF SEA WATER BY DIFFERENCE CHROMATOGRAPHY. SUMMARY OF PROGRESS, 1969-70,

Woods Hole Oceanographic Institution, Mass.

For primary bibliographic entry see Field 02L.

W72-10986

BUDGET OF CALCIUM CARBONATE, SOUTHERN CALIFORNIA CONTINENTAL BORDERLAND,

Hawaii Inst. of Geophysics, Honolulu.

S. V. Smith.

J Sedimentary Petrology. Vol 41, No 3, p 798-808. 1971. Maps.

Identifiers: Benthos, Borderland, Budget, Calcium, California, Carbonate, Continental, Foraminifera, Macro, Southern, USA.

The transfer of particulate CaCO₃ to or from the water mass of the Southern California Continental borderland can be described by means of a budget. The sum of mechanical plus biological plus chemical transfer must equal zero if the system is one of steady state. Deposition of CaCO₃ on the basin floors, on the slopes, and on the shelf totals 125 x 10¹⁰ g/yr. River supply of particulate CaCO₃ totals 16 x 10¹⁰ g/yr. No other mechanical transfer processes are quantitatively significant. Biological production of CaCO₃ includes approximately 40 x

10¹⁰ g/yr by macrobenthos of the shallow rocky shelf, 34 x 10¹⁰ g/yr by other macrobenthos, 247 x 10¹⁰ g/yr by planktonic plus benthic foraminifera, and 25 x 10¹⁰ g/yr by other organisms. Chemical transfer includes solution of 200 x 10¹⁰ g/yr CaCO₃. The CaCO₃ transfer terms sum to zero, within the limits of error. The carbonate minerals present include Mg-calcite (> greater than 0.04), Mg-calcite (less than 0.04), aragonite, and dolomite. All carbonate minerals other than dolomite show evidence of solution. Most of the Ca deposited in Borderland sediment is derived from ocean waters flowing through the Borderland rather than from river water input. Water associated with O2 minimum is important in dissolving particulate CaCO₃. The shallow water precipitation and intermediate water solution may be an important process of dissolved Ca relocation from one water mass to another.—Copyright 1972, Biological Abstracts, Inc.

W72-11031

GROUNDWATER IN POLK COUNTY, NEBRASKA,

Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 07C.

W72-11081

2L. Estuaries

THE ORIGIN OF ACOUSTICALLY TURID SEDIMENTS IN CHESAPEAKE BAY,

Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.

J. R. Schubel, and E. W. Schiemer.

Special Report 23, Reference 72-5, April 1972. 21 p, 9 fig, 7 ref.

Descriptors: *Sediments, *Acoustics, *Sounding, *Turbidity, *Chesapeake Bay, Investigations, On-site tests, Estuaries, Data collections, Analytical techniques, Particle size, Gases, Bubbles.

Identifiers: *Acoustically turbid sediments, Gas bubbles, Shell beds, Sound penetration.

Many shallow water, fine-grained sediments, particularly in bays and estuaries, are almost acoustically impenetrable to the energy from high resolution continuous seismic profilers with peak outputs of up to 2-3 kJ at frequencies of 0.2-10 kHz. Determinations of the compressibility of sediments from acoustically impenetrable zones and from contiguous zones of good penetration in Chesapeake Bay showed that the acoustically turbid sediments are several orders of magnitude more compressible than acoustically clear sediments of very similar grain size. The increased compressibility is a result of the presence of interstitial gas bubbles. Other acoustically turbid zones are produced by buried shell beds, and do not show an increase in compressibility. (Woodard-USGS)

MYALL LAKES--AN ANCIENT AND MODERN MONUMENT,

Sydney Univ. (Australia). School of Biological Sciences.

For primary bibliographic entry see Field 02H.

W72-10530

THE MYALL LAKES AND REGIONAL DEVELOPMENT,

Hunter Valley Research Foundation, Tighe Hill (Australia).

For primary bibliographic entry see Field 02H.

W72-10531

ABUNDANCE AND DISTRIBUTION OF YOUNG ATLANTIC MENHADEN, BREVOORTIA TYRANNUS, IN THE WHITE OAK RIVER ESTUARY, NORTH CAROLINA,

National Marine Fisheries Service, Beaufort, N.C.

Center for Estuarine and Menhaden Research.

Field 02—WATER CYCLE

Group 2L—Estuaries

For primary bibliographic entry see Field 05C.
W72-10549

INTRODUCTION TO: COASTAL ZONE MANAGEMENT: MULTIPLE USE WITH CONSERVATION.
For primary bibliographic entry see Field 06G.
W72-10575

NATIONAL GOALS, STATE'S INTERESTS, AND JURISDICTIONAL FACTORS,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 06G.
W72-10576

CONSERVATION OF BIOLOGICAL RESOURCES OF THE COASTAL ZONE,
California Univ., Berkeley.
For primary bibliographic entry see Field 06G.
W72-10577

SOCIAL NEEDS AND THE URBAN-MARINE ENVIRONMENT,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 06G.
W72-10578

TRAFFIC AND TRANSPORT NEEDS AT THE LAND-SEA INTERFACE,
Department of Commerce, Washington, D.C.
For primary bibliographic entry see Field 06G.
W72-10579

CONSERVATION OF MINERAL RESOURCES OF THE COASTAL ZONE,
California State Lands Commission, Sacramento.
For primary bibliographic entry see Field 06G.
W72-10580

SYSTEMS PLANNING AND CONTROL: COASTAL REGIONS,
Litton Industries, Inc., Beverly Hills, Calif.
For primary bibliographic entry see Field 06G.
W72-10581

INFORMATION SYSTEMS AND DATA REQUIREMENTS: COASTAL DEVELOPMENT PLANNING,
Naval Postgraduate School, Monterey, Calif.
For primary bibliographic entry see Field 06G.
W72-10582

OCEAN INSTALLATIONS: STATE OF TECHNOLOGY,
Naval Civil Engineering Lab., Port Hueneme, Calif.
For primary bibliographic entry see Field 06G.
W72-10583

MARINE WASTE DISPOSAL SYSTEMS: ALTERNATIVES AND CONSEQUENCES,
California Univ., Berkeley.
For primary bibliographic entry see Field 06G.
W72-10584

GROWTH OF THE TREPANG STICHOPUS JAPONICUS IN PETER THE GREAT BAY, (IN RUSSIAN),
Akademiya Nauk SSSR, Vladivostok. Institut Morskogo Biologii.
Y. E. Bregman.
Zool Zh. Vol 50, No 6, p 839-846. 1971. Illus. English summary.
Identifiers: Fisheries, Growth, *Peter the Great Bay, *Stichopus japonicus*, *Trepang, USSR.

The size-age structure of the trepang population in the Troitz Bay was studied by the graphic method

(probability paper method). On this basis the growth curves for the body and the musculocutaneous sac were constructed and mathematically described. The theoretical maximum average possible life duration was determined as equal to 9 (8 to 10) yr. The data obtained suggest that the conditions in the closed Troitz Bay are not optimal for the trepang.—Copyright 1972, Biological Abstracts, Inc.
W72-10593

TRACE ELEMENTS IN THE WATER RESOURCES OF CALIFORNIA,
Soil Science and Engineering, Riverside, Calif.
For primary bibliographic entry see Field 05A.
W72-10597

EUTROPHICATION IN COASTAL WATERS: NITROGEN AS A CONTROLLING FACTOR.
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 05C.
W72-10611

THE KOKANEE, A SALMON ADAPTED TO LIVING IN FRESH WATER,
Conseil Supérieur des Pêches Cerafer (France).
Division de la Qualité des Eaux.
B. Barber.

Bull Franc Piscicult. Vol 241, p 127-155. 1971. Illus. Maps.

Identifiers: Competition, *Freshwater, Kokanee, *Oncorhynchus nerka* kennerlyi, *Oncorhynchus nerka* nerka, *Salmon.

The salmon is an amphibiotic fish: in its normal life it successively frequents fresh water and sea water, then at maturity migrates to the streams from which it originated in order to reproduce. If migration is an environmental defense mechanism of the species with the purpose of optimum satisfaction of nutritional requirements and the accomplishment of reproduction, then the impossibility of migrating (due to industrialization) represents quite a danger to the salmon. However, certain varieties are naturally adapted to a holobiotic life in fresh water. One such fish is the Kokanee, the dwarfed land-locked form of the anadromous red sockeye: *Oncorhynchus nerka* kennerlyi Suckley (or *O. nerka* nerka Walbaum). Following a review of the habitat, growth, nutritional requirements, competition with other species, and reproduction of this salmon plus its ages and sizes at maturity, efforts that have been made at introducing it into various places were briefly discussed. With regard to the compatibility of a possible introduction of this species into France with the protection of the native French salmon, both measures do seem compatible judging from the success of such a program in Sweden. However, the introduction of the Kokanee into certain French lakes should be accompanied by careful discrimination as to the origin of the eggs and by preliminary studies on interspecific competition.—Copyright 1972, Biological Abstracts, Inc.
W72-10614

OCEANIC OVERWASH AND ITS ECOLOGICAL IMPLICATIONS ON THE OUTER BANKS OF NORTH CAROLINA,
National Park Service, Washington, D.C. Office of Natural Science Studies.

P. J. Godfrey.
April 8, 1970. 37 p, 14 fig, 22 ref.

Identifiers: *Coasts, *Atlantic Ocean, *Islands, *Beach erosion, *North Carolina, Storms, Overflow, Environmental effects, Ecology, Natural use, Sand spits, Berms, Sea nettles, Ocean waves, Littoral drift, Shores, Shore protection, Tides.
Identifiers: *North Carolina Outer Banks.

The area of study of oceanic overwash is the barrier island system of North Carolina between Beaufort Inlet and Ocracoke Inlet (the region that will

become the Cape Lookout National Seashore). These islands provide an excellent opportunity to study the ecology and physiography of barrier islands still in their natural state. Man is the barrier island's worst enemy, not the sea. Barrier islands have an intrinsic mechanism for surviving enormous oceanic forces. Man's interference with this mechanism with the thought he is improving or restoring the 'natural ecology' may, in fact, lead to the very breakdown he is trying to prevent. The vegetation that survives on low barrier islands is well adapted to conditions of overwash (the process whereby storm-driven sea water completely inundates the barrier islands and sand moves from the beach face toward the back of the island. Contrary to generally accepted interpretations, this process is not destructive, but constitutive, if undisturbed by man. It is the means by which the ocean builds and moves the barrier islands, and this movement is essential for their continued survival. (Woodard-USGS)
W72-10632

STUDY OF THE BEHAVIOR OF DISSOLVED SILICA IN THE ESTUARY OF THE SCHELDT,
Brussels Univ. (Belgium).
R. Wollast, and F. De Broeck.
Geochimica et Cosmochimica Acta, Vol 35, No 2, p 613-620, February 1971. 1 fig, 3 tab, 14 ref.

Descriptors: *Silica, *Dissolved solids, *Estuaries, *Chemical reactions, Investigations, Freshwater, Sea water, Correlation analysis, Chemical analysis, Environmental effects, Sediment transport, Suspended solids, Salinity, Diatoms, Clay minerals.
Identifiers: *Scheldt estuary (Belgium and Netherlands), Silica behavior.

Evolution of the silica dissolved in the Scheldt estuary (Netherlands and Belgium) shows that the reduction in silica content is much greater than that predicted by the dilution curve computed from the mixture of fresh water rich in silica and surface sea water. The removal of silica from the solution is not due to a reaction with clay minerals in suspension, but to biological activity, essentially by diatoms that live preferentially in saline waters. After death, diatoms that become part of the sediments return silica to the interstitial waters, which can then combine with disordered clays of continental origin to give rise to new aluminosilicates richer in silica and in alkaline or alkaline-earth ions. (Woodard-USGS)
W72-10636

SEA WATER INTRUSION EXTRACTION BARRIER,
California State Dept. of Water Resources, Los Angeles. Southern District.
For primary bibliographic entry see Field 08A.
W72-10643

PROPOSED JETTY-HEAD REPAIR SECTIONS, HUMBOLDT BAY, CALIFORNIA: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W72-10669

COASTAL ZONE PROCESSES AND THEIR INFLUENCE ON ESTUARIAN CONDITIONS,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 05G.
W72-10676

SURVEY OF TOXAPHENE LEVELS IN GEORGIA ESTUARIES,
Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 05B.
W72-10678

WATER CYCLE—Field 02

Estuaries—Group 2L

DISPOSAL OF LIQUID WASTES INTO COASTAL WATERS,
Battelle Memorial Inst., Richland, Wash.
For primary bibliographic entry see Field 05B.
W72-10683

CHARTING OF SUBTIDAL OYSTER BEDS AND EXPERIMENTAL PLANTING OF SEED OYSTERS IN SOUTH CAROLINA,
Bear's Bluff Labs., Wadmalaw Island, S.C.
W. J. Keith, and H. S. Cochran, Jr.
Available from the National Technical Information Service as COM-72 10033, \$3.00 in paper copy, \$0.95 in microfiche. Contribution No 48 Dec 1 1971, 22 p.

Descriptors: *Aquaculture, *Oysters, Fisheries, Animal growth, Mortality, Salinity, Turbidity, Brackish water, *South Carolina.

A survey of tidal areas of South Carolina was conducted for inventory purposes and to gain knowledge of conditions necessary to sustain subtidal oysters. Transplantings were made for growth and mortality studies. Marketable subtidal oysters can be grown from seed in South Carolina provided certain bottom conditions and other factors such as salinity and turbidity are favorable.
W72-10697

MIGRATION, GROWTH AND MORTALITY OF NORTH CAROLINA PINK AND BROWN PENAEID SHRIMP,
North Carolina Div. of Commercial and Sport Fisheries, Raleigh.
E. G. McCoy.

Available from the National Technical Information Service as COM72-10095, \$3.00 in paper copy, \$0.95 in microfiche. Special Scientific Report No. 15, Jun 68, 30 p., 11 fig, 15 ref, NMFS 2-26 R.

Descriptors: *Shrimp, *North Carolina, *Pink shrimp, Animal growth, Mortality, Migration patterns, Fisheries, Life cycles, Fishing, Estuaries, Shellfish.
Identifiers: *Brown shrimp, Penaeus aztecus, Penaeus duorarum.

Information was obtained to enable the North Carolina Department of Conservation and Development to apply management techniques that will result in the highest possible sustained yield of the shrimp resource. Pink and brown shrimp were marked with biological stains and fluorescent pigments and released in areas tributary to Pamlico Sound. A total of 4,467 pink and 6,947 brown shrimp was released from June to September 1967. Of these 135 (3.0%) pink and 1,061 (15.3%) brown shrimp were returned. Data are presented on migration routes of pink shrimp, growth of pink and brown shrimp, and estimates of total mortality of brown shrimp.
W72-10703

CLAM SHELL PLANTING FOR OYSTER CULTCH,
Louisiana Wild Life and Fisheries Commission, New Orleans.
J. Tarver.

Available from the National Technical Information Service as COM72-10093, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, November 1970, 10 p, 5 fig. NMFS-2-114-D.

Descriptors: Fishing, *Oysters, Clams, Louisiana.
Identifiers: Oyster cultch, Oyster beds, Spat.

Dredge run clam shells no smaller than 3/8 inch diameter were planted in May and June of 1970 to provide oyster cultch for the oyster fishermen's use in September 1971 and in subsequent years. The shells were washed overboard using six high-pressure water hoses powered by two diesel pumps with about 70 psi pressure on a 1.25 inch nozzle. A total of 2,255 superficial acres were planted with 55,248.6 cubic yards of clam shell in 35 days at a cost of approximately \$200,000.00. In

addition, the subproject 2-101-D was completed simultaneously and contributed 13,433 cubic yards. Periodically, clam shells were dredged and oyster spat were counted, measured, and recorded. Initial examinations of the shell indicate that some set occurred and future catches of spat in September and October are anticipated.
W72-10704

SOME IMPORTANT INORGANIC NITROGEN AND PHOSPHORUS SPECIES IN GEORGIA SALT MARSH,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
For primary bibliographic entry see Field 02K.
W72-10706

DAILY VARIATIONS OF THE ION CONTENT IN SALICORNIA EUROPaea DEPENDENT ON LOCATION AND OVERFLOODING, (IN GERMAN),
Technische Hochschule, Darmstadt (West Germany), Botanisches Institut.
D. J. Von Willert.

Ber Deut Bot Ges. Vol 81, No 10, p 442-449, 1968 (1969). Illus. English summary.
Identifiers: Chloride, Daily, *Flooding, *Ion content, Location, Ratios, *Salicornia europaea-D, Seasons, Sodium, Variations.

Salicornia europaea growing in ditches in the tidal zone undergoes periodic immersion by seawater. These plants have a lower Na and chloride sap concentration than those plants which grow on levees and are not flooded. At early stages of development (June) the Na to chloride ratio is 1:1.1 for ditch plants. This ratio does not differ from that determined in Aug. when plants are flowering. The ratio for levee plants increases from 1:0.8 in June to 1:1 in Aug. (seawater 1:1.2). The Na and chloride concentration in stems of both ditch plants and levee plants decreases at high tide although only ditch plants undergo immersion. It seems that Na and chloride ions are translocated from shoot to root from which they are washed out.—Copyright 1972, Biological Abstracts, Inc.
W72-10867

A SYMPOSIUM ON THE BIOLOGICAL SIGNIFICANCE OF ESTUARIES.
Sport Fishing Inst., Washington, D.C.
For primary bibliographic entry see Field 05C.
W72-10870

MONTHLY FLUCTUATION OF THE LARVAE AND GROWTH OF THE MUSSEL PERNA PERNA (L.) AND THE ENVIRONMENTAL CONDITIONS OF THE INLET OF GUATAPANARE, STATE OF SUCRE, VENEZUELA, (IN SPANISH),
Universidad de Oriente, Cumana (Venezuela). Inst. of Oceanography.

J. Carvajal-Rojas.
Bol Inst Oceanogr Univ Oriente Cumana. Vol 8, No 1/2, p 13-20, 1969. Illus. Map. English summary.
Identifiers: *Environment, Fluctuation, Growth, *Inlet of Guatapanare, Larvae, Monthly, *Muscles, Perna-perna, Sucre, Venezuela.

The monthly fluctuation of P. perna larvae indicates the existence of 3 increments of planktonic larvae, corresponding to Dec.-Jan., March and June-July. Similarly, there are 3 possible spawning periods. The growth study started with mean sizes of 5.1 mm in length by 3.3 mm in width and was continued until the means reached 74.5 mm length by 39.2 mm width. The smallest increments coincided with the presence of 'red tide' in the bay. The mean surface salinity was 36.49‰ with extremes of 35.71‰ and 36.87‰. The mean surface temperature was 26.0°C; the highest (30°C) occurred from Sept. to Nov., and the lowest (21.8°C) in March. The O₂ content in the water (at 20 cm

depth) had a mean value of 4.17 ml/l. The Secchi disk depth had a mean of 80 cm.—Copyright 1972, Biological Abstracts, Inc.
W72-10872

TOXICITY AND DISTRIBUTION OF AROCLOR 1254 IN THE PINK SHRIMP PENAUS DUORARUM,
Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Lab.
For primary bibliographic entry see Field 05C.
W72-10876

SEASONAL VARIATION IN THE CHEMICAL COMPOSITION OF THE OYSTER, CRASSOSTREA RHIZOPHORAE (GULDING) IN THE GRAND LAGOON AND THE BAY OF MOCHIMA, (IN SPANISH),
Universidad de Oriente, Cumana (Venezuela). Inst. of Oceanography.
J. Bonilla-Ruiz, A. Benitez, and T. Okuda.
Identifiers: *Chemical composition, Crassostrea rhizophorae, Grand Lagoon, Bay of Mochima, *Oysters, *Seasonal, Venezuela.

The seasonal variation in the chemical composition of C. rhizophorae (Guldung) was observed in Laguna Grande and Bahia de Mochima (Venezuela) from March, 1966 to Dec., 1967. Two size groups of oysters were studied, 4-6 cm and 6-8 cm shell length. The 2 groups showed similar seasonal variation in fresh weight, dry weight, water content, and chemical components. Higher concentration of carbohydrates and crude fat occurred between March and May in 1966 and between March and Sept. in 1967. There was a greater increase in these components in Laguna Grande than in Bahia de Mochima. There was an inverse relationship between crude protein and ash (the principal components of oyster) and the carbohydrates and crude fat. This was especially marked in dry weight measurements. Both the concentration of chemical components and the weight of oysters were higher in Laguna Grande than in Bahia de Mochima during the period of study.—Copyright 1972, Biological Abstracts, Inc.
W72-10889

COASTAL ZONE BASELINES AND MONITORING FOR POLLUTION AND ENVIRONMENTAL QUALITY.
National Academy of Sciences-National Research Council, Washington, D.C.
For primary bibliographic entry see Field 05A.
W72-10901

MARINE MICROBIOLOGICAL STUDIES OF MANGROVE SWAMPS OF KILAI BACKWATERS,
Tamil Nadu Government Fisheries Research Station, Porto Novo (India).
For primary bibliographic entry see Field 05C.
W72-10941

ANALYSIS OF SEA WATER BY DIFFERENCE CHROMATOGRAPHY. SUMMARY OF PROGRESS, 1969-70,
Woods Hole Oceanographic Institution, Mass.
P. C. Mangelsdorf, Jr., and R. S. Wilson.
Available from NTIS as NYO-3835-5, \$3.00 in paper copy, \$0.95 microfiche. Report No. NYO-3835-5 (COO-3119-1), (1971). 21 p, 13 fig, 2 tab, 8 ref. AEC (30-1)-3838.

Descriptors: *Chromatography, *Water analysis, *Sea water, Estuarine environment, Path of pollutants, Sediment-water interfaces, Instrumentation, Analytical techniques, Technology, Connate water, Sampling, Fluvial sediments, Bottom sediments, Cation exchange, Calibrations, Marine geology, Pacific Ocean, Atlantic coastal plain, Sodium, Potassium, Magnesium, Calcium.
Identifiers: Caribbean Sea, Mediterranean Sea.

Field 02—WATER CYCLE

Group 2L—Estuaries

Interaction between sea water and East Coast fluvial sediments was studied, and water from Pacific deep-sea sediments and from the Caribbean and the Mediterranean was analyzed. Use of a new cation exchange resin and of higher operating pressures improved the resolution of the analytical method. A 20 cm long column of 3 mm inside diameter was packed with 400 mesh resin. Columns were repacked with fresh resin every 5 days. A constant flow pump gave the advantage that the peak positions remained unchanged. (Bopp-ORNL)
W72-10986

OBSERVATIONS OF THE ZOOPLANKTON IN THE MALAMOCCO CHANNEL (LAGOON OF VENICE): PRELIMINARY REPORT,
Istituto di Biologia del Mare, Venice (Italy).
A. Comaschi, P. Franco, and D. Voltolina.
Atti Ist Veneto Sci Lett Art Ci Sci Math Nat. Vol 127, p 291-299, 1969. Illus. Map. English summary.
Identifiers: Cladocerans, Copepods, Italy,
"Lagoon of Venice, Malamocco Channel, Mollusks, "Plankton, Seasonal, Variations, Venice.

The most common species of zooplankton identified in the Venice lagoon are copepods, cladocerans and mollusks. The cladocerans are directly related to temperature and inversely related to salinity. Copepods and their larval stages were the most common organisms. Population densities showed seasonal variations.—Copyright 1972, Biological Abstracts, Inc.
W72-10990

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

HYDRAULICALLY-CONTROLLED MULTISTAGE FLASH APPARATUS,
Secretary of the Navy, Washington, D.C. (assignee).

John S. Williams.

U. S. Patent No. 3,533,917, 5 p, 1 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 879, No 2, p 559, October 13, 1970.

Descriptors: *Patents, *Desalination, Sea water, *Flash distillation, *Evaporation, Brines, *Evaporators, Separation techniques, Equipment, *Distillation.

This hydraulically controlled equipment includes a feed tank, a multistage evaporator, a feed water heater and ducts for conducting feed water through the evaporator and heater. The heater employs waste heat from diesel electric generators or other similar sources. The waste heat provides a temperature source for heating the feed water. A vacuum system for the evaporator is provided by forming a circuit leading from the feed water tank through water jet eductors of a venturi type and back into the feed water tank. Waste brine is pumped from the final stage and, to avoid pump cavitation and possible leakage, a pilot-controlled reverse acting, diaphragm valve controls the pump action. (Sinha-OEIS)
W72-10743

MULTISTAGE FLASH DISTILLATION APPARATUS WITH VERTICAL FLASH COLUMN,
United Kingdom Atomic Energy Authority, London (England). (assignee).

I. H. Newson, and P. Walker.

U. S. Patent No. 3,533,916, 2 p, 2 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 879, No 2, p 558, October 13, 1970.

Descriptors: *Patents, Desalination, *Flash distillation, *Desalination processes, Water quality, *Desalination apparatus, Separation techniques, Condensation, Distillation.

In this multistage flash distillation apparatus steam is generated in a vertical flash column. Flash stages are defined by different temperature and pressure conditions. The condenser in the form of a tower is divided by horizontal plates. The steam from the various stages is fed to an appropriate section of the condenser tower. The tower contains a means for cooling and risers pass through the plates to connect adjacent sections. The condensate flash boils in the risers and can be withdrawn from the top tower section. (Sinha-OEIS)
W72-10745

PROCESS FOR EXTRACTING SOLVENT FROM A SOLUTION,

W. T. Hough.

U. S. Patent No. 3,532,621, 6 p, 1 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 879, No 1, p 222, October 6, 1970.

Descriptors: *Patents, *Desalination, Sea water, *Osmosis, Semipermeable membranes.

This invention provides a process for separating a solvent from a solute dissolved therein. Natural osmosis through a semi-permeable membrane is utilized for the desalination of sea water. (Sinha-OEIS)
W72-10748

WATER PURIFICATION APPARATUS WITH THREE CHAMBERS AND CONTROLS,

F. Sibert.

U. S. Patent No. 3,532,606, 2 p, 1 fig, 12 ref; Official Gazette of the United States Patent Office, Vol 879, No 1, p 220, October 6, 1970.

Descriptors: *Patents, *Water purification, Sea water, *Distillation, *Desalination apparatus, Equipment, Vapor, Water treatment, Heat exchangers.

Sea water is conducted from a supply tank, to a control tank, to a boiler, where it is vaporized, leaving behind its salts as a residue. The heated or condensed vapor is passed through the supply tank in heat exchange relation with the sea water therein where it is pre-conditioned by temperature for distillation. (Sinha-OEIS)
W72-10749

MULTI-EFFECT EVAPORATOR,

Foster Wheeler Corp., Livingston, N.J. (assignee).

J. W. Cartinhour.

U. S. Patent No. 3,532,152, 3 p, 4 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 879, No 1, p 120, October 6, 1970.

Descriptors: *Patents, *Evaporators, Evaporation, *Desalination, Sea water, Brine, Separation techniques, Vapor compression distillation, Distillation.

This multiple effect evaporator system eliminates the water effect piping complex, separate heat regeneration exchangers, and water effect pumps. Liquid to be evaporated passes through a lower temperature effect to a consecutive higher temperature effect in a series of effects, distributing successive portions of the liquid to the effects while keeping the undistributed liquid separate. Steam is supplied to the highest temperature effect of the series in indirect heat exchange with the last remaining liquid portion to partially vaporize the steam and pass the vapor to the lower temperature area in indirect heat exchange. The heated sea water in the brine chamber flashes into vapor which passes under a weir and over another weir to condense on the tubes in the next area. (Sinha-OEIS)
W72-10751

DISTILLATION OF SALINE WATER TO RECOVER FRESH WATER,

Aluminum Co. of America, Pittsburgh, Pa. (assignee).

M. H. Brown.

U. S. Patent No. 3,528,890, 4 p, 12 fig, 12 ref; Official Gazette to the United States Patent Office, Vol 878, No 3, p 733, September 15, 1970.

Descriptors: *Patents, *Distillation, Saline water, Separation techniques, *Water purification, Sea water, *Evaporation, *Condensation, Water vapor, Gases.

Identifiers: *Vaporization.

Saline water is evaporated at less than atmospheric pressure producing a gaseous mixture containing water vapor and a non-condensable gas. The gas mixture is subjected to condensation during which recovery of a substantial portion of the water vapor content is effected. Further condensation is effected during the gas removal step. The invention is procedural in character and does not provide for any particular apparatus. (Sinha-OEIS)
W72-10757

VERTICAL MULTISTAGE FLASH EVAPORATION AND DIRECT CONTACT CONDENSATION,

Maschinenfabrik Augsburg-Nuernberg A. G., Nuernberg (West Germany).

B. Kunst.

U. S. Patent No. 3,649,471, 2 p, 6 fig, 13 ref; Official Gazette of the United States Patent Office, Vol 896, No. 2, p 709, March 14, 1972.

Descriptors: *Patents, *Flash distillation, *Condensation, *Desalination, Separation techniques, Water quality, *Distillation.

The multistage flash evaporation and direct contact condensation are combined with hydrostatic compensation both on the solvent and solution sides of the pressure differences between consecutive stages. The liquid depths in the evaporation and condensation chambers of all stages are kept approximately at the same low level by compensating for the hydrodynamic head losses by means of the lifting effect produced by solution stage vapor. (Sinha-OEIS)
W72-10766

SALT WATER DISTILLATION AND CONDENSATION SYSTEM AND METHOD,

W. L. Bourland.

U. S. Patent No. 3,527,675, 4 p, 4 fig, 10 ref; Official Gazette of the United States Patent Office, Vol 878, No. 2, p 425, September 8, 1970.

Descriptors: *Patents, *Distillation, *Condensation, Saline water, Brackish water, Water pollution, Water pollution treatment, Pollution abatement, Steam, Separation techniques, Water purification, *Desalination.

The apparatus consists of an outer vessel which is cooled to condense and collect vapors, a salt water or polluted water containing vessel set in the outer vessel, and a cylinder with a sliding piston inside the salt water container. Interconnecting systems supply steam to the inside cylinder alternately at opposite sides of the piston. The piston is moved and the steam condensed thus transferring latent heat to the salt water to produce vapor which is condensed and collected in the outer vessel. The temperature in each end of the cylinder is maintained at approximately 160 degrees. The pressure is controlled by a special valve mechanism and by condensation and heat transfer. (Sinha-OEIS)
W72-10774

REVERSE OSMOSIS-ION EXCHANGE WATER PURIFICATION,

Union Tank Car Co., Chicago, Ill. (assignee).

For primary bibliographic entry see Field 05D.

W72-10775

THE DISPOSAL OF WATER BRINE FROM DESALTING OPERATIONS,

Dow Chemical Co., Freeport, Tex.

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

Water Yield Improvement—Group 3B

W. F. McIlhenny, M. A. Zeitoun, and P. G. Legros.
Proceedings, Industrial Waste Conference, 25th, May 7-9, 1970, p 559-574, 12 fig, 8 tab.

Descriptors: *Brine disposal, *Design data, *Desalination, Oceans, Outlet works, *Diffusion, Deep wells, Pumping, Evaporation, Ponds, Costs, Installation costs, Operating costs, Meteorological data, Geological surveys, Copper, Toxicity, Jets, Outlets, Injection wells.
Identifiers: *Jet diffusers.

The disposal of waste brine from desalting operations was investigated for both coastal and inland locations. Trace metal ions, especially copper, have added to disposal problems at coastal locations. A copper concentration of 0.05 mg/l was toxic at 20 deg. C to the most important primary producers-diatoms and dinoflagellates. The effects of copper on plankton and benthic organisms were also reported. A laboratory investigation was conducted on the jet mixing action from a diffuser for outfall disposal for a coastal desalination plant. A jet at a 60 degree angle from the horizontal produced the longest trajectory and, therefore, the highest dilution of any of the jets studied. A method of design of outfalls for economic analysis was illustrated. Conceptual designs of outfall systems for 2, 5, 10 and 50 MGD desalination plants were made, and a summary of the capital and operating costs for the diffuser outfalls was presented in tabular form. Total costs ranged from 0.66 to 9.1 cents/1000 gallons for the 50 and 2 MGD plant diffusers respectively. For inland plants deepwell reinjection or evaporation in ponds were determined to be feasible disposal solutions. Specific site information on the meteorological conditions as well as the geological substrata must be obtained. Developed unit operating costs varied from 4.0 to 15 cents per 1000 gal. of product water for deepwell injection disposal. Total costs of disposal by pond evaporation varied from .18 to 1.29 dollars/1000 gallons of product water. (Gal-wardi-Texas)
W72-11061

3B. Water Yield Improvement

FOURWING SALT BUSH REVEGETATION TRIALS IN SOUTHERN ARIZONA.
Forest Service (USDA), Tucson, Ariz. Rocky Mountain Forest and Range Experiment Station. D. R. Cable.
Journal of Range Management, Vol. 25, No. 2, p 150-153, March 1972. 4 fig, 1 tab, 5 ref.

Descriptors: *Shrubs, *Xerophytes, *Vegetation establishment, *Range management, *Water conservation, Creosote, Mesquite, Herbicides, Germination, Moisture stress, Arizona, Arid lands, Vegetation effects.
Identifiers: *Saltbush, *Seedlings.

Fourwing saltbush (*Atriplex canescens*), one of the most widely distributed and important shrubs on western ranges, has been used for revegetation many times with varying degrees of success. Exploratory studies designed to determine some of the environmental limitations for establishment of the plant in the semiarid southwest were conducted for 4 years on an experimental range in southern Arizona. The long-range goal was to replace some species of little or no grazing value with a highly desirable forage species. The saltbush was seeded and transplanted into native stands of almost pure creosotebush and of velvet mesquite with a burroweed understory. The shrubs were killed by picloram spray and by grubbing. Although it was shown that saltbush survival was higher on creosotebush sites with calcareous soils and that transplants survived better on grubbed plots than on sprayed or check plots, after 3 years the trials had to be considered failures from the standpoint of permanent establishment. It is possible part of the failure was due to germination and seedling mortality because the experiment was conducted during drought

years. This indicates a need for moisture conservation. There was higher emergence on mesquite-kill plots which is rather surprising in view of the well-known ability of mesquite to use available soil moisture at the expense of associated plants. (Casey-Arizona)
W72-10513

* A NEW APPROACH TO ESTIMATING HERBAGE MOISTURE CONTENT,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station. For primary bibliographic entry see Field 04A.
W72-10514

LAND USE IN WAH WAH AND PINE VALLEYS, WESTERN UTAH,
Brigham Young Univ., Provo, Utah. Dept. of Botany; and Brigham Young Univ., Provo, Utah. Dept. of Range Science; and Brigham Young Univ., Provo, Utah. Center for Environmental Studies.
For primary bibliographic entry see Field 04A.
W72-10515

LEAFLESS EUPHORBIA ON RAJASTHAN (INDIA) ROCKS. IV. WATER RELATIONS OF SEEDLINGS AND ADULT PLANTS,
Jodhpur Univ. (India). Dept. of Botany.
D. S. Sen, and D. D. Chawan.
Vegetatio, Vol. 24, No. 1-3, p 193-214, 1972. 6 fig, 8 tab, 19 ref.

Descriptors: *Xerophytes, *Leaves, *Plant growth, *Soil-water-plant relationships, *Physiological ecology, Arid lands, Shrubs, Plant morphology, Ecological distribution, Plant physiology, Water balance, Variability, Vegetation effects.

Leafless spurge (*Euphorbia caducifolia*) is a photosynthesizing, perennating, latex containing, fleshy plant which remains leafless for a major part of the year. It occupies well-drained, extremely xeric sites in the Rajasthan Desert. The appearance of leaves in late summer and their fall in late rainy season seemed to be an endogenous rhythmic phenomenon hardly related to ecophysiological behavior of the plants. The species contains an abundance of latex unmatched by any other species in the region. The amount and quality of latex in the plant determines their water content, which varies widely among individuals of the population. Stem latex water percentages ranged from 48.7 to 74.2. Leaf appearances were accompanied by stem growth. Newly grown stem parts had higher water percentages as compared to older stem parts or leaves. Water contents of older stem parts were highly variable while the water contents of leaves from differing plants did not much differ. Germination and seedling growth were evident in the rainy season and, like leafing, seemed endogenously controlled. The individuals of the species exhibit remarkable diversity as regards water relations, but the water turnover never reached a permanent water deficiency state even under extreme xeric conditions. (Casey-Arizona)
W72-10519

THE CONCEPT OF ECO-SYSTEM AS EXEMPLIFIED BY THE VEGETATION OF WESTERN RAJASTHAN,
Central Arid Zone Research Inst., Jodhpur (India). For primary bibliographic entry see Field 021.
W72-10522

PHYTOSOCIOLOGICAL CHARACTERISTICS OF PERENNIAL ATRIPLEX DOMINATED VEGETATION OF SOUTHEASTERN UTAH,
Utah State Univ., Logan. Dept. of Range Science; and Utah State Univ., Logan. Ecology Center.
For primary bibliographic entry see Field 021.
W72-10524

GEOLOGY AND WATER RESOURCES OF THE SPANISH VALLEY AREA, GRAND AND SAN JUAN COUNTIES, UTAH,
Geological Survey, Salt Lake City, Utah.
For primary bibliographic entry see Field 02F.
W72-10732

METHOD AND APPARATUS FOR RETARDING EVAPORATION FROM WATER SURFACES,
Research Corp., New York. (assignee).
C. O. Reiser.
U. S. Patent No. 3,528,764, 5 p, 9 fig, 10 ref; Official Gazette of the United States Patent Office, Vol 878, No 3, p 709, September 15, 1970.

Descriptors: *Patents, Evaporation, *Evaporation control, *Monomolecular films, *Reservoir evaporation, *Alcohols, *Water loss.
Identifiers: *Oleaginous films.

A monomolecular film of oleaginous material, such as a straight chain fatty alcohol, is applied onto the surface of a body of water to reduce water losses. An emulsion of the oleaginous material is formed and is applied to the water surface. It is formed by aspirating liquid oleaginous material into a moving stream of water to disperse it. The material is then sprayed onto the surface to form a monomolecular surface film. (Sinha-OEIS)
W72-10758

ANTITRANSPIRANTS-EFFECTS AND USES IN HORTICULTURE,
California Univ., Davis. Dept. of Water Science and Engineering; and California Univ., Davis. Dept. of Pomology.
For primary bibliographic entry see Field 03F.
W72-10904

WATER YIELD INCREASED FROM PARTIAL CLEARCUTTING OF FORESTED WATERSHED,
Pennsylvania State Univ., University Park. Coll. of Agriculture.
For primary bibliographic entry see Field 04C.
W72-11073

TEN COUNTIES INVESTIGATION--MUNICIPAL, INDUSTRIAL, AND AGRICULTURAL WATER DEMAND IN COLUSA, GLENN, HUMBOLDT, LAKE, MARIN, MENDOCINO, NAPA, SOLANO, SONOMA, AND YOLO COUNTIES,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 06D.
W72-11075

CIBECUE RIDGE JUNIPER PROJECT,
Geological Survey, Tucson, Ariz.
R. M. Myrick.
In: Proceedings 15th Annual Arizona Watershed Symposium, September 22, 1971: Arizona Water Commission Report No 1, p 35-39, 1971. 6 fig, 4 ref.

Descriptors: *Water yield improvement, *Range management, *Arizona, *Rainfall-runoff relationships, *Simulation analysis, Model studies, Grasslands, Land management, Revegetation, Demonstration watersheds, Vegetation establishment.

The Cibecue Ridge Project, Arizona, was initiated in 1958 to study the effects of juniper and pinyon eradication on streamflow. The method of analysis was the standard practice of paired watersheds. Two small watersheds of approximately equal size and representative of the juniper and pinyon woodlands are located on the eastern slope of Gila County. The basin which has been cleared has an area of 42 acres with silty loam soils 2 to 6 feet deep. Twelve inches of precipitation during the 60-day period following seeding resulted in a good stand of grass by the end of the summer of 1967.

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3B—Water Yield Improvement

The Geological Survey digital-computer model was used to develop the Cibecue Ridge Watershed model to predict runoff from a small storm. The error between predicted and observed flow, for 1964 through 1966 in the cleared watershed and for the entire period of record on the control watershed, ranged between +34% and -28%. Thus the model is capable of detecting a change in water yield greater than about 30%. Even though much of this difference may be due to modeling error or natural environmental changes, clearing did increase runoff for 1967 and 1968. For 1969 and 1970, however, the predicted flows were 54% greater and 118% greater, respectively, than those observed, indicating a decrease in runoff for the cleared area, probably related to revegetation with grasses. (Knapp-USGS) W72-11086

3C. Use of Water of Impaired Quality

THERMAL WATER MAY BE A MARKETABLE BYPRODUCT,
Vitro Corp. of America, New York. Agro-Engineering Div.
C. W. Nilsson.

Water and Wastes Engineering p. E-6, E-7, E-12, September 1971. 1 fig, 2 tab, 2 photo, 8 ref.

Descriptors: *Thermal water, Agriculture, Growth rates, Frost protection, Orchards, Oregon, *Irrigation, Temperature, Cooling, *Crop response.

In a project started in September 1968 thermal water from the condensers of a pulp and paper plant was used in agriculture. Cooling water varying in temperature from 90 F to 120 F was pumped through buried lines to sprinkler irrigation systems at farms with orchard and row crops. Meteorological instruments continually record environmental conditions and changes created by the thermal water. The project demonstrated frost protection of early fruit buds, feasibility of irrigation of orchard and row crops, cooling of various crops under adverse summer weather conditions, and undersoil heating. Heat for frost protection comes from heat released as the water sprinkled over the plants turns to ice. Yield comparisons between pole beans irrigated with thermal water and those irrigated with well water showed little difference. Because of thermal changes which take place as water passes through the air from a sprinkler nozzle, thermal water is as effective as well water in reducing air temperature in the summer. Plants immediately over buried thermal water delivery lines grew at accelerated rates. (Eagle-Vanderbilt) W72-10553

SALT WATER IRRIGATION SYSTEM,

D. C. Falk.
U. S. Patent No. 3,528,251, 2 p, 4 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 878, No. 3, p. 581, September 15, 1970.

Descriptors: *Patents, *Irrigation systems, Sea water, Salt water, Subsurface irrigation, *Water yield improvement, *Impaired water use.

This invention provides a subsurface trough-like structure at a depth about equal to the root system of the crop to be grown. A barrier above the water surface prevents entry of soil into the trough but permits water vapor to move out of the trough into the adjacent soil. Since there is direct contact between the liquid water and the soil, there is no tendency for the water to soak into and poison the soil. The trough may be a pipe having perforated walls well above the level of the salt water. (Sinha-OEIS) W72-10772

DEEP TUNNELS IN HARD ROCK.
Wisconsin Univ., Milwaukee. Coll. of Applied Science and Engineering.
For primary bibliographic entry see Field 05G.

W72-10834

THE IMPACT OF THE DEEP TUNNEL PLAN ON WATER RESOURCES IN THE CHICAGO AREA,
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 05G.
W72-10838

THE MOISTURE AND SALINITY REGIME OF CISCAUCASIAN FLOODPLAIN SOILS,
S. P. Sokolovskii, and G. S. Solopov.
Nauka: Moscow. 1970. 143 p.
Identifiers: *Saline soils, Control, Evaporation, Floodplains, Grape D, Irrigation, *Soil moisture, Paddy M, Salination, Transpiration, USSR, Vegetables, Salt tolerance.

The moisture and salinity regime in the aeration zone and the groundwater regime of floodplain territories are described. The "critical" depths of groundwater tables in the floodplains of the rivers Kuma, Kalaz and Bol'shoi Egorlyk, the pore solutions, salt tolerance of paddy, grapes and vegetables, as well as methods for estimating transpiration, evaporation and irrigation water losses are described. Recommendations are provided for the control of salination and bogging of irrigated areas.—Copyright 1972, Biological Abstracts, Inc.
W72-10999

STUDIES ON THE TOLERANCE OF PADDY TO DIFFERENT SALTS,
Agricultural Coll., Vellayani (India).
P. G. Nair, and N. Subramony.
Agr Res J Kerala, Vol 8, No 1, p 1-5, 1970 (recd. 1971), Illus.
Identifiers: *Saline soils, *Crop response, Flooding, Growth, Magnesium, Paddy M, *Rice M, Salt concentration, Sodium, Tolerance.

The saline soils of Kerala have originated mainly as a result of salt water flooding. During rainy seasons, swept by flood waters, the surface soils in such areas get partly desalinized. During cropping season, the water resources get salinized due to tidal influences. Rice often suffered injury due to high salt concentrations. No precise information is available on the effect of various concentrations of salt on the various life processes of paddy except the observations of Zacharia and Sankarasubramony that salt tolerance of paddy plants increased as they matured. In the present studies varying concentrations of salts were produced in the soil artificially and the influence of different concentrations of the various salts on the growth and yield characteristics of rice were observed. Studies were also made on the possibilities of lessening the injurious effect of Na by the addition of Mg salts.—Copyright 1972, Biological Abstracts, Inc.
W72-11039

3D. Conservation in Domestic and Municipal Use

POPULATION DENSITY AS AN INDIRECT INDICATOR OF URBAN AND SUBURBAN LAND-SURFACE MODIFICATIONS,
Geological Survey, Trenton, N.J.
For primary bibliographic entry see Field 04C.
W72-10733

3F. Conservation in Agriculture

WATER FOR SOUTHERN NEVADA: PART 1,
Montgomery (James M.) Consulting Engineers, Inc., Pasadena, Calif.
For primary bibliographic entry see Field 04B.
W72-10471

ACTIVITY OF PHOTOSYNTHETIC APPARATUS AND PRODUCTIVITY OF WINTER WHEAT AND SPRING BARLEY UNDER CONDITIONS OF IRRIGATION, (IN RUSSIAN),
E. S. Tkachuk.

Fiziol Biokhim Kul't Rast. Vol 3, No 2 p 171-175. 1971. (English summary).

Identifiers: Barley M, Growth, Inhibition, *Irrigation, Photosynthesis, Productivity, Spring, Wheat M, Winter, *Soil-water-plant relationships, *Crop response, Crop production.

In winter wheat and spring barley under conditions of constant moisture deficit in the soil (40% of total soil moisture capacity) the content of photosynthetic pigments, photochemical activity of leaf homogenate and activity of redox enzymes and respiration increased; energy supply in macroergic bonds and increment of dry matter were inhibited. Prevalence of hydrolytic reactions over synthetic ones under these conditions caused inhibition of growth and a decrease in plant productivity. A decrease in yield with surplus (90%) soil moisture occurred in connection with inhibition of the intensity of both synthetic and hydrolytic processes.—Copyright 1972, Biological Abstracts, Inc.
W72-10477

IN THE YEAR 2070,
Food and Agriculture Organization of the United Nations, Rome (Italy). Policy Advisory Bureau.
For primary bibliographic entry see Field 06B.
W72-10512

IRRIGATION DEVELOPMENT IN THE CENTRAL BASIN OF THE OGALLALA FORMATION—THE PAST AND THE FUTURE,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics; and Haile Selassie I Univ., Alemt Mayo (Ethiopia). Dept. of Agricultural Economics.
V. Eidman, and S. Bekure.
Oklahoma Current Farm Economics, Vol. 45, No. 1, March 1972. p 3-13. 7 tab, 1 fig, 2 ref.

Descriptors: *Irrigation practices, *Economic prediction, *Oklahoma, *Groundwater mining, History, Forecasting, Water table, Aquifers, Water loss, Farm management, Irrigable land, Markets, Crop production, Grains (Crops), Cattle, Farm equipment, Seeds, Fertilizers, Pesticides, Irrigation water, Water yield, Pumping, Costs, Net income, Land management, Farm prices, Water supply development, Water management (Applied), Water conservation, Groundwater recharge, Water importing.
Identifiers: *Irrigation development, Agribusiness.

Water-table declines in the Oklahoma panhandle raise questions concerning future irrigation and farm practices. The history and future of irrigation in the panhandle and adjoining irrigated areas mining the common aquifer, the Central Basin of the Ogallala are discussed. Irrigation increased rapidly in the area overlying the Central Ogallala. Soils suitable for irrigation and a market for crops at current prices will be available for expanded crop production. Levels of saturated aquifer are defined and economically related and projected to farm practices. A growing economy is projected for 20 years based on further development of groundwater. Grain production and cattle feeding will increase. Agribusiness (farm machinery, irrigation equipment, petroleum products, seed, fertilizer and pesticides) will increase. Well yields will decline as pumping costs increase. Declining net returns per acre under irrigation is expected to reduce land values; irrigated acres and net farm income will decline in the early 1990's. Alternative management schemes are being evaluated by agriculturalists to find means of avoiding the projected decline in irrigation and the area economy. Improved irrigation methods resulting in more production per unit water volume, techniques to increase recharge, and water importation are being considered. (Popkin-Arizona)

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

Conservation in Agriculture—Group 3F

W72-10516

COTTON: A COLLEGE OF AGRICULTURE REPORT.

Arizona Univ., Tucson. Cooperative Extension Service; and Arizona Agricultural Experiment Station, Tucson.

University of Arizona, Cooperative Extension Service, Agricultural Experiment Station, Series P-24, February 1972, 102 p, 53 tab, 1 diag, 27 ref.

Descriptors: *Cotton, *Research and development, *Irrigation, *Fertilization, *Testing, Annual, Irrigated land, Arid lands, Economics, Plant breeding, Weed control, Plant diseases, Nematodes, Insect control, Plant physiology, Varieties, Irrigation practices, Aeration, Leaves, Soil moisture, Plant populations, Humidity, Fruit crops.

Identifiers: *Underground irrigation.

Results of cotton research and demonstrations conducted during 1971 by the University of Arizona and the U. S. Department of Agriculture are summarized. Cotton is a major irrigated and non-irrigated cash crop in many arid and semiarid lands. Areas of research include economics, narrow-row and high population cotton, short staple and extra long staple cotton breeding, irrigation and fertilization, weed control, disease and nematode control, insect control, and cotton physiology. Irrigation studies include irrigation spacing variety tests, underground irrigation, soil aeration and irrigation practices. Research is conducted on leaf water status and soil moisture, and spacing and humidity effects on fruiting and shedding. (Popkin-Arizona)

W72-10518

AGRICULTURE'S CONTRIBUTIONS TO THE NATION'S WATER RESOURCES AND FLOOD CONTROL,

Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.

L. M. Glymph.

Journal of Environmental Quality, Vol. 1, No. 2, p 128-133, 1972. 8 fig, 18 ref.

Descriptors: *Water conservation, *Water quality, *Water pollution sources, *Land management, *Agriculture, Environmental effects, Watershed management, Fertilizers, Sediments, Flood control, Hydrologic cycle, Runoff, Infiltration.

The points of source and loss of water for agriculture are identified. As national water demands approach the available supply, all options for meeting water requirements must be adequately evaluated and implemented as water demands approach the available water supply. The Federal Water Resources Council has reported that water shortages in the southwest have become more acute and will spread into other regions during the 1970's. The potential for influencing water regimes by land use management schemes is bound to be looked at much more objectively in the future. The results of exploitative agricultural land use vs. conservative agricultural land use will have to be carefully evaluated in terms of their effects on critical water supply parameters such as runoff and infiltration. The magnitude of annual flood damage is described and there is a discussion of the potentials for reducing annual flood losses and creating other water resource values by project-type activities in upstream watersheds. People in agriculture must recognize and accept their responsibility for the maintenance of water quality. This includes the problems of sediments, pesticides, chemical fertilizers, animal wastes, salinity, processing wastes and land disposal of sewage effluents, all of which are discussed in detail. (Casey-Arizona)

W72-10520

ROLE OF PLANTS IN IMPROVING THE ENVIRONMENT,

Connecticut Agricultural Experiment Station, New Haven.

P. E. Waggoner.
Journal of Environmental Quality, Vol. 1, No. 2, p 123-127, 1972. 3 fig, 1 tab, 16 ref.

Descriptors: *Vegetation effects, *Air pollution, *Agriculture, *Productivity, *Environmental effects, Ozone, Nitrates, Energy budget, Cooling, Soil stabilization, Filters, Field crops, Stomata, Mode of action.

By virtue of its high productivity, agriculture pollutes, this has been inevitable because of the national demand for low-cost, high quality food. Now, if it wants to do more than enjoy a fit of environmental morality, society must start paying a bill that has been long accruing. It is stressed that the plants of modern agriculture do more than supply foodstuffs. The shade of a tree, for instance, by decreasing incoming solar radiation and its reflection, incident on a human being, facilitate his maintenance of a steady-state heat load. Population pressures and resulting food demands place parks and wilderness under a cloud, and related to this extensification is the pollution attendant upon a more intensified agriculture. Other important functions of plants include the uptake of N and P from our wastes and the healing of scarred and eroded land resulting from strip mining, farming and forest fires. Finally, by simulating canopy conditions, it is shown that plants are a significant factor in cleansing the ozone of automobile exhaust from the air. (Casey-Arizona)

W72-10521

FREQUENCY OF POTENTIAL EVAPOTRANSPIRATION RATES IN CENTRAL GREAT PLAINS,

Nebraska Univ., Lincoln. Dept. of Horticulture and Forestry.

For primary bibliographic entry see Field 02D.

W72-10525

FINAL REPORT: AUTOMATIC DOWNSTREAM CONTROL SYSTEMS FOR IRRIGATION CANALS,

California Univ., Berkeley. Hydraulic Engineering Lab.

For primary bibliographic entry see Field 08C.

W72-10526

PLANNING FOR WATER AND POWER UTILISATION,

Snowy Mountains Hydro-Electric Authority, Cooma (Australia).

H. E. Dann.

Ecological Society of Australia, Proceedings, Vol. 5, p 81-85, 1970. 3 ref.

Descriptors: *Environmental effects, *Dams, *Ecology, *National parks, Diversion structures, Planning, Water resources development, Vegetation effect, Sedimentation, Water quality, Water temperature, Australia, Hydroelectric power, Irrigation water.

Identifiers: Snowy Mountains Scheme (Australia).

If arid Australia is to grow and develop, her water resources must be utilized to the maximum. The Snowy Mountains Scheme was planned as a dual purpose project in which the 2 products are hydroelectric power and irrigation water. The scheme involved the construction of 16 large dams, over 90 miles of tunnels, surface and underground power stations, a pumping station and some 50 miles of covered aqueducts. Much of the construction took place within the bounds of Kosciusko National Park, much of which was formerly inaccessible. Much effort was taken to protect watersheds and generally integrate the scheme with the ecology of its surroundings. Alternative damsites for the prevention of erosion, river improvement and bank protection and improved fire fighting programs were part of the project. The various programs, considerations of vegetation, sedimentation and water quality insure that the effects of the scheme on areal ecology have been minimal and in some respects it is argued that im-

provements have ensued from the enlightened environmental protection programs. (Casey-Arizona)

W72-10532

ECOLOGICAL HAZARDS OF THE SNOWY MOUNTAINS SCHEME,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.

For primary bibliographic entry see Field 06G.

W72-10533

GERMINATION BEHAVIOR OF A WEED AND THREE RELATED CROP PLANTS UNDER VARIOUS CONDITIONS OF SOIL WATER CONTENT AND TEMPERATURE,
Shivaji Coll., New Delhi (India). Dept. of Botany.

S. P. Shukla.

Journal of the Indian Botanical Society, Vol. 50, No. 3, p 272-276, 1971. 2 tab, 6 ref.

Descriptors: *Soil-water-plant relationships, *Germination, *Seeds, *Weeds, Crop response, Soil moisture, Rainfall, Agronomic crops, Temperature.

A comparative study was made of the seeds of the tropical weed, Portulaca oleracea, and 3 related crop plants, under various ranges of temperature and water contents. The seeds of the weed germinated over a wider temperature range than all but one of the crop plants. At least some of the Portulaca seeds germinated at 20% moisture levels, while the crop seeds generally required more than 30% moisture. Inhibition of germination due to high moisture levels was observed in all seed species. Since the weed seeds became germinable well before the others, it is possible to stimulate germination early so that the weeds may be eradicated and the fields prepared for the rainy season crops. (Casey-Arizona)

W72-10534

INFLUENCE OF THE AGRICULTURAL COMPLEX MEASURES ON GROWTH AND CONSUMPTIVE USE OF WATER BY IRRIGATED MAIZE (IN BULGARIAN),
Institute of Water Engineering and Land Improvement, Sofia (Bulgaria).

A. Hristov, and G. Tashkov.

Rastnivod Nauki, Vol 8, No 3, p 31-44, 1971, Illus, English summary.

Identifiers: Agriculture, *Irrigation, Bulgaria, Daily, Fall, Forests, Growth, *Maize M, Measures, Moisture, Rain, *Soil-water-plant relationships, Leached soils.

An experiment was conducted on leached cinnamon forest soil and under conditions characterized by insufficient rainfall during the growing season. Yield, growth, development and consumptive use of water by maize were studied. A good correlation between soil moisture and maize growth was observed during the growth stage from May to mid-July (especially after the formation of the 9th leaf). A decrease in the mean daily rate of growth to 3-3.5 cm corresponds to soil moisture of about 70% of field capacity for this soil type. This magnitude of soil moisture, however, varies depending on meteorological conditions. In most years irrigation is needed during the growth stage. The mean daily growth may serve as an index for determining the data and, approximately, the water application. The biological coefficient (R) and the ratio of consumptive use of water to evaporation from free water surface are not constant. A correction in the formula for calculating the coefficient R is suggested.—Copyright 1972, Biological Abstracts, Inc.

W72-10551

DROUGHT HARDENING OF THE POTATO PLANT AS AN AFTER-EFFECT OF SOIL DROUGHT CONDITIONS AT PLANTING,
Cuyo Univ., Mendoza (Argentina). Facultad de Ciencias Agrarias.

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F—Conservation in Agriculture

J. B. Cavagnaro, B. R. DeLis, and R. M. Tizio. Potato Res. Vol 14, No 3, p 181-192. 1971. Illus. Identifiers: *Aftereffects, *Drought, Hardening, *Potato D, Tuberization, Soil-water-plant relationships.

Drought at planting time delayed tuber set of 'White Rose' potato, shortened the tuber formation period, increased tuber number, promoted their active bulking and produced a significant increase in yield. When soil drought conditions were permitted to develop at the beginning of the tuberization stage, the tuber formation period was lengthened to the detriment of their number, growth and yield. These detrimental effects almost disappeared when planting was done under high soil moisture stress. Thus, drought hardening at the critical stage of water requirement occurred as an after-effect of drought at planting time.—Copyright 1972, Biological Abstracts, Inc. W72-10565

WATER POLLUTION AND AGRICULTURE, Kansas State Department of Health, Topeka. Environmental Health Services. For primary bibliographic entry see Field 05B. W72-10592

USE OF ISOTOPES AND RADIATION IN RESEARCH ON SOIL-PLANT RELATIONSHIPS INCLUDING APPLICATIONS IN FORESTRY. REVIEW OF THE JOINT FAO/IAEA SYMPOSIUM HELD AT VIENNA, DEC. 13-17, 1971, International Atomic Energy Agency, Vienna (Austria).

D. A. Nethsinghe. Atomic Energy Review, Vol. 10, No. 1, p 155-162. 1972.

Descriptors: *Soil-water-plant relationships, *Radioisotopes, *Radioactivity techniques, *Tracers, Conferences, Europe, Foreign research, Soil moisture, Irrigation, Ions, Absorption, Analytical techniques, Soil chemistry, Soil environment, Nutrient requirements, Forests, Trees, Cycling nutrients.

A total of 55 papers were presented at the meeting, 18 were on forestry, covering the areas of tree physiology, ecology and mineral cycling, and soil and water regimes. The other six sessions dealt with ion-uptake and translocation, soil chemistry and analytical methods, soil fertility and nutrient availability, and soil moisture and irrigation. The complete Proceedings of the Symposium will be published in Vienna by the International Atomic Energy Agency. (Bopp-ORN)

W72-10679

ON THE CHANGES OF SOME BIOCLIMATIC ELEMENTS IN SIMPLE HOTBEDS DEPENDENT ON THEIR GEOGRAPHICAL POSITION, (IN BULGARIAN), T. Murtasov, Draganov, and P. Kartalov. Gradijan Lozar Nauka. Vol 7 No 5 p 71-80. 1970. Illus.

Identifiers: Cucumber D, *Geographical position, Hotbeds, Lettuce D, Light, Temperature, Tomato D, *Crop response.

The intensity of the sun's rays and the average daily, minimum and maximum temperatures were most favorable to plant development in hotbeds with southern orientation and least favorable to that of hotbeds with northern orientation. Soil moisture was higher in northerly oriented hotbeds, a feature favorable to plant development in the spring. Shadows were smallest in Feb.-Nov. in southerly oriented beds and largest in northerly oriented ones. From March to May the shadows are smallest in southerly and northerly oriented beds and largest in the westerly and easterly oriented beds. Hotbeds with southerly and northerly oriented windows were most favorable for the development of lettuce in autumn and netted tomato, southerly and easterly oriented windows for cucumbers. Windows with southern ex-

posure were most favorable for various types of production.—Copyright 1972, Biological Abstracts, Inc. W72-10680

EFFECT OF SOIL COMPACTNESS ON THE GROWTH AND PRODUCTIVE FEATURES OF THE WINTER WHEAT (IN BULGARIAN), Academy of Agricultural Sciences, Sofia (Bulgaria). Central Lab. for Agrophysical Investigations.

A. Ivanov.

Rastenievod Nauki, Vol 8, No 4, p 15-23. 1971. Illus. English summary.

Identifiers: *Soil compactness, Growth, *Wheat-M, Winter, Soil-water-plant relationships, *Crop response.

Various indices characterizing the soil biological activity, the development and the day and night plant increment, leaf-area, transpiration, over-ground and under-ground biomass, and the elements of the yield structure were studied. Winter wheat growth and productivity indicators are closely dependent on the rate of compactness of the leached chernozem-smolnitza soil. In all tests conducted the most favorable conditions for the wheat both in the initial and in the later stages of development exist at soil compactness in the range of 1.0-1.2 g/cm², which under the softening effect of the irrigation water shifted toward the range of 0.95-1.15 g/cm². In those ranges the compactness of leached chernozem-smolnitza soil is optimal for the plants. At higher or lower rates of soil compactness the winter wheat productive capacity is limited and the yields are lower. The differences in the amount of grain obtained are statistically confirmed in all tests in favor of the optimal compactness of the soil.—Copyright 1972, Biological Abstracts, Inc.

W72-10753

IRRIGATION SYSTEM,

R. W. Fiala.

U. S. Patent No. 3,648,465, 2 p, 4 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 2, p. 470, March 14, 1972.

Descriptors: *Patents, *Irrigation systems, Application equipment, *Furrow irrigation, Conservation, Agricultural engineering.

A simplified irrigation system is provided for automatically distributing an equal amount of water to individual furrows. A rigid structure is mounted in the ground adjacent to the reservoir. Boreholes extend along a line parallel with the furrows. A pipe within each bore hole leads directly to the individual furrow. (Sinha-OEIS)

W72-10768

SALT WATER IRRIGATION SYSTEM,

For primary bibliographic entry see Field 03C.

W72-10772

PRECIPITATION RATE GAGE FOR SPRINKLER IRRIGATION SYSTEMS,

G. F. Larson.

U. S. Patent No. 3,526,201, 2 p, 2 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 878, No. 1, p. 61, September 1, 1970.

Descriptors: *Patents, *Sprinkler irrigation, *Irrigation, Conservation, Agriculture, Water distribution, *Gages, Precipitation gages.

A gage is provided for indicating the amount of liquid collected at any location within a sprinkler irrigation system. The gage is so designed that when a specific amount of water falls in the cup, the combination of the displacement of the signal float and the length of the adjustable stud will result in the signal float disengaging from the stud and dropping by gravity thus signalling the observer. (Sinha-OEIS)

W72-10777

STUDIES ON SOYA GROWN FOR GRAIN: 1. POST HARVEST GROWING OF SOYA FOR GRAIN UNDER IRRIGATION, (IN BULGARIAN), Academy of Agricultural Sciences, Stara Zagora (Bulgaria) Inst. of Animal Husbandry.

A. Hristozov, and B. Stoimenov.

Rastenievod Nauki. Vol 8 No 2 p 51-60. 1971. Illus. (English summary).

Identifiers: Barley M, Bulgaria, Grains, Harvest, *Irrigation, Meadows, Protein, Soil, *Soya D, Winter, *Crop response, Crop production.

Field experiments were conducted in order to establish the possibilities of post-harvest growing of certain soybean cultivars for grain. The tests were conducted in meadow-cinnamon soils with slight alkaline reaction (pH 8.13) under irrigation. Soybean was sown in late June and was harvested in the middle of Oct. The temperature conditions in the region were favorable for growing soybean for grain with winter barley as predecessor. The crop should be grown only under irrigation since the precipitation is insufficient. Grain yields were comparatively high and steady but there were considerable differences in the yield between the cultivars. Highest yields were obtained from 'Merit-212' and the lowest from 'Fundulja-645.' 'Iregi' and 'Flambo' were highly productive. The grain obtained possesses good seed properties. The crude protein content varies from 40 to 46%. Highest crude protein content in the grain and straw (1-75%) was encountered in '93-II-g.' All the soybean cultivars tested were equally suitable for growing as a post-harvest crop for grain.—Copyright 1972, Biological Abstracts, Inc.

W72-10784

INSECTICIDE RESIDUES IN A STREAM AND A CONTROLLED DRAINAGE SYSTEM IN AGRICULTURAL AREAS OF SOUTHWESTERN ONTARIO, 1970,

Department of Agriculture, London (Ontario).

For primary bibliographic entry see Field 05B.

W72-10798

MOISTURE USE ESTIMATION AND RELATIONSHIP BETWEEN MOISTURE USE AND NITROGEN RESPONSE IN WINTER WHEAT,

Kansas Water Resources Research Inst., Manhattan.

For primary bibliographic entry see Field 02D.

W72-10805

USE OF REACTOR COOLING WATER FROM NUCLEAR POWER PLANTS FOR IRRIGATION OF AGRICULTURAL CROPS,

Oregon State Univ., Corvallis. Water Resources Research Inst.

For primary bibliographic entry see Field 05D.

W72-10807

PHYSIOLOGICAL RESPONSE OF DWARF WHEAT VARIETIES TO VARIOUS MOISTURE REGIMES,

Punjab Agricultural Univ., Ludhiana (India). Dept. of Botany Plant Pathology.

O. S. Singh, and Ashwani K. Srivastava.

J Res Punjab Agric Univ. Vol 7 No 4 Suppl. p 667-673. 1970. Illus.

Identifiers: Grains, Moisture stress, Wheat-M, *Crop response, *Soil moisture, *Plant physiology.

Five dwarf varieties, growing in steel drums containing sandy-loam soil, were subjected to 4 levels of moisture stress to find out their response to varying conditions of water regimes imposed at 4 developmental stages of plants. Plants subjected to the high-moisture regime (100% and 70% available moisture) developed higher-yield components. When soil water fell to 60% and 90% of that of available moisture, significant decrease in yield components was obtained. Stress during flowering was the most potent in reducing the grain number and the grain weight, irrespective of the varieties.

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

Conservation in Agriculture—Group 3F

Severe moisture stress during the drought stage did not produce any deleterious effect. 'Sonara-64' was judged to be drought resistant and 'PV-18' and 'Kalyan-227' drought susceptible.—Copyright 1972, Biological Abstracts, Inc.
W72-10857

STUDIES ON THE INFLUENCE OF HUMIDITY ON THE POPULATION DYNAMICS OF LEPIDOPTERA, (IN PORTUGUESE), Instituto de Pesquisas e Experimentacao Agropecuarias do Sul, Rio Grande do Sul (Brazil). A. Bertels.

Pesqui Agropecu Brasil. Vol 5, p 67-79, 1970. Illus. English summary.
Identifiers: Corn M., Dynamics, *Humidity, *Lepidoptera, Pests, Population.

Experiments were conducted in Pelotas, Rio Grande do Sul, Brazil on the influence of humidity on the population dynamics of Lepidoptera plagues in corn. The practical objective was to indicate the planting season of least susceptibility to larval invasion.—Copyright 1972, Biological Abstracts, Inc.
W72-10864

EFFECT OF GIBBERELLIN AND THE RETARDANT CCC (CHLOROCHOLINE CHLORIDE) ON DROUGHT HARDINESS OF BARLEY, (IN RUSSIAN), Akademiya Nauk SSSR, Moscow. Inst. of Plant Physiology.

K. A. Badanova, and V. V. Levina. Fiziol Rast. Vol 17, No 3, p 568-574, 1970. Illus. English summary.

Identifiers: *Barley-M., *Chloroquine chloride, Chlorophyll, Chloroplasts, Drought, *Gibberellin, Growth, Hardiness, Heat, Resistance, Retardant, Seeds, *Crop response.

Barley plants were cultivated from drought-hardened and unhardened seeds in soil culture, with a soil moisture between 40 and 70% of the total water capacity. Three-leaflet plants were sprayed 3 times at intervals of 7 days with a 0.01% gibberellin solution (35 ml/10 plants) or watered with a 0.5% chloroquine chloride (CCC) solution (100 ml CCC/kg soil). Regardless of water supply, gibberellin stimulated growth and accelerated development of the plants; the retardant exerted an opposite effect. Gibberellin lowered the number of plastids in the cells and protoplasm viscosity did not change. The retardant increased the number of plastids in the cells and pigment content and the amount of bound water but lowered protoplasm viscosity. CCC also slightly increased drought resistance, while gibberellin lowered heat and drought resistance.—Copyright 1972, Biological Abstracts, Inc.
W72-10904

IRRIGATION PLANNING 4. OPTIMAL INTERSEASONAL WATER ALLOCATION, Montana State Univ., Bozeman. Dept. of Economics; and Montana State Univ., Bozeman. Dept. of Agricultural Economics. N. J. Dudley.

Water Resources Research, Vol. 8, No. 3, p 586-594, June, 1972. 4 tab, 4 ref.

Descriptors: *Irrigation engineering, *Irrigation operation and maintenance, *Acreage, *Irrigation water, *Water transfer, Water supply, Water demand, Water consumption, Reservoirs, Seasonal, Dynamic programming, Simulation analysis, Optimization, Estimating, Benefits, Net profit, Decision making, Systems analysis, Soil moisture, *Model studies.
Identifiers: *Reservoir water, *Interseasonal transfer, *Interseasonal water allocation, Computer output.

A series of models has been developed in previous papers to estimate the best sized area to develop

for irrigation from a given reservoir under conditions of variable supply and demand for irrigation water. The most economically feasible operating policies for such a system were also derived. The previous approach is extended by recognizing the value of water carried over from one season to the next. A modified version of the previous approach is used to generate reservoir level transition probabilities and expected benefits. A dynamic programming model is then used to estimate the expected benefits from allocating water optimally between seasons. These expected benefits are a function of acreage developed for irrigation and beginning-season reservoir levels. Such a function allows a decision maker at any decision point within an irrigation season to equate the expected net benefits from allocating water to the rest of the current season with the expected net benefits from saving such water for the following season. This decision-making process is simulated for a number of seasons. The results of an application of the models indicate that such interseasonal transfer can considerably increase the present value of expected benefits from the project. (Bell-Cornell)
W72-10890

ANTITRANSPIRANTS-EFFECTS AND USES IN HORTICULTURE,

California Univ., Davis. Dept. of Water Science and Engineering; and California Univ., Davis. Dept. of Pomology.

D. C. Davenport, and K. Uriu, M. A. W. Fisher, and R. M. Hagan. American Horticulture Magazine, p 110-113, Summer 1971. 2 fig, 11 ref. OWRR B-054-CAL (3).

Descriptors: *Antitranspirants, *Evapotranspiration control, *Horticulture, *Water conservation, *Soil-water-plant relationships, Plant physiology, Leaves, Emulsions, Oil, Alcohols, Resins, Plastics, Photosynthesis, Testing, Methodology.
Identifiers: Silicones, Latexes.

One of the most promising developments in horticulture is the use of materials on foliage to control water loss of plants. Recent developments in this new field of antitranspirants are reported. By slowing water loss from leaves, these wile-proofing materials keep the plant more turgid even though watering is needed less often. There are three types of antitranspirants: (1) compounds that form a film over the stomates; (2) chemicals that prevent complete stomatal opening; and (3) materials that reflect incoming radiation back from the leaves. Since stomates are portals for both loss of water vapor and intake of carbon dioxide, covering the stomates or reducing their openings curtails water loss and photosynthesis. The film-forming group of compounds includes waxes, wax-oil emulsions, high alcohols, silicones, plastics, latexes, and resins. (Woodard-USGS)
W72-10904

TRANSPORT OF H₂O₁₈ INTO MAIZE LEAVES UNDER VARIOUS CONDITIONS OF ANAEROBIOESIS, (IN RUSSIAN), Akademiya Nauk SSSR, Moscow. Inst. of Plant Physiology.

G. M. Grineva, and Z. S. Burkina. Fiziol Rast. Vol 18, No 1, p 158-163. 1971. Illus. English summary.

Identifiers: *Anaerobiosis, Consumption, Dehydration, Inundation, Leaves, *Maize M., Oxygen, Oxygen-18, Roots, Tissues, Water transport.

The effect of root anaerobiosis (up to 7 days) and general anaerobiosis (up to 48 hr) on H₂O₁₈ transport into the maize leaves was studied. The transport of H₂O₁₈ into the leaves during the root inundation was found to decrease by 30-50%. At the same time, however, the total water consumption often increased, probably due to a low water-retaining ability of the leaves and the stem basal part under conditions of a high water content during the inundation. The transport of H₂O₁₈ into the leaves increased after general anaerobiosis ir-

respective of its duration. The stimulation of the water transport by general anaerobiosis is supposed to be caused by the dehydration of the leaf tissues when O₂ is not available for the aboveground organs.—Copyright 1972, Biological Abstracts, Inc.
W72-10936

EFFECT OF THE QUALITY OF THE WATER ON THE TRANSPORT OF SR AND CS RADIOISOTOPES IN RICE IRRIGATION, (INFLUENCE DE LA QUALITE DE L'EAU D'IRRIGATION SUR LE TRANSFERT DU RADIOCESIUM ET DU RADIOSTRONTIUM EN RIZIERE IRRIGUEE), European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

For primary bibliographic entry see Field 05B.
W72-10973

THE EFFECT OF IRRIGATION AND NITROGENOUS FERTILIZERS ON THE GROWTH AND GLYCOSIDAL CONTENT OF DIGITALIS LANATA,

Cairo Univ., Giza (Egypt). Faculty of Pharmacy. S. I. Balbaa, S. H. Hialal, and M. Y. Haggag. Planta Med. Vol 20, No 1, p 54-59. 1971.
Identifiers: Ammonium sulfate, *Digitalis lanata D., *Fertilizers, Glycosidal content, Growth, *Irrigation, Nitrogen compounds, *Crop response.

The effect of nitrogenous fertilizers (ammonium sulfate) applied at different levels and irrigation at different intervals on the growth and glycosidal content of *D. lanata* Ehrh. grown in Egypt was studied. The growth of *D. lanata* plants was favored by the application of 100 kg/acre of ammonium sulfate fertilizer with irrigation at 5 to 10 day intervals. The nature and percentage of glycosides were not significantly affected by any of the fertilizer or irrigation treatments studied.—Copyright 1972, Biological Abstracts, Inc.
W72-10979

EFFECT OF COMPACTED INTERCALATION ON SOIL MOISTURE EVAPORATION,

I. D. Gromyko. Dokl Mosk S-Kh Akad Im K A Timiryazev. Vol 154, p 5-9. 1969.
Identifiers: Compacted soil, Crops, Evaporation, *Intercalation, Irrigation, *Soil moisture, *Soil treatment.

Soil with an intercalation at a depth of 5-7 cm retained 13.4 mm more moisture which was equivalent to additional irrigation of 134 m³ water/ha. The practical need for soil packing simultaneously with the sowing of crops is indicated.—Copyright 1972, Biological Abstracts, Inc.
W72-11000

SOIL EROSION AND ITS CONTROL IN THE CHERNIGOV REGION,

O. S. Skorodumov. Zemlerobstvo Resp Mizhvid Temat Nauk Zb. Vol 21, p 78-85. 1970.
Identifiers: Chernigov Region, *Erosion control, Soils, *Tillage, USSR.

Practices for the tillage of underwinter fallow and crop interrows to control erosion are discussed.—Copyright 1972, Biological Abstracts, Inc.
W72-11003

WATER BALANCE OF CHERNOZEMS IN THE LUGANSK REGION IN RELATION TO SHEET EROSION AND SOIL-FORMING ROCKS,

L. I. Akent'eva. Tr Lugansk S-Kh Inst. Vol 12, p 70-77. 1969.
Identifiers: *Water balance, *Chernozems, Corn M., Erosion, Lugansk Region, Rocks, Soils, USSR.

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F—Conservation in Agriculture

Data with emphasis on the water supply of corn plants and on various rubby calcareous chernozems are given.—Copyright 1972, Biological Abstracts, Inc.
W72-11004

SOIL WATER SUCTION AND ROOT TEMPERATURE EFFECTS ON NITROGEN FIXATION IN SOYBEANS, Oregon State Univ., Corvallis. Dept. of Soil Science.

T. Kuo, and L. Boersma.
Agron J. Vol 63, No 6, p 901-904. 1971. Illus.
Identifiers: Glycine max D, *Nitrogen fixation, Photosynthesis, *Root temperature, Soybeans D, Temperature, Transpiration, *Soil water suction.

The effect of soil water suction and root temperature on rates of N fixation, transpiration, and net photosynthesis of soybeans (*Glycine max* (L.) Merr.) was studied in laboratory experiments. The range of root temperature and soil water suction considered was 15.6 to 37.8 C and 0.30 and 2.50 bars, respectively. With increasing root temperature rates of N fixation, transpiration and photosynthesis increased slowly at first and then rapidly until an optimum temperature was reached followed by a decrease at higher temperatures. Optimum temperatures were 27, 30, and 27 C for rates of N fixation, transpiration, and net photosynthesis, respectively. Rates of the 3 parameters decreased with increasing soil water suction. The amount of N fixed per unit of CO₂ absorbed was highest at a root temperature of 23.9 C and lowest at 37.8 C. This ratio decreased with increasing soil water suction at all temperatures considered. Changes in transpiration rate resulting from changes in soil temperature were attributed to temperature effects on viscosity and metabolic activity. Effects of soil water suction and soil temperature on N fixation indicated in this study emphasize the complex symbiotic nature of the process. Mechanisms by which the 2 environmental parameters might affect the rate of fixation were indicated but not clearly elucidated by the results.—Copyright 1972, Biological Abstracts, Inc.
W72-11016

THE INFLUENCE OF IAA UNDER VARIOUS CAPILLARY WATER ABSORPTION CAPACITIES OF SAND ON SPRING WHEAT AND SPRING BARLEY YIELDS, (IN POLISH), Instytut Hodowli i Aklimatyzacji Roslin, Warsaw (Poland). Zaklad Biofizyki Roslin.

W. Norwakowski.
Hodowla Rosi Akl Im Nasieni. Vol 15, No 2, p 176-187. 1971. Illus. English summary.
Identifiers: Absorption, Barley M, Capillary, Sand, Spring, Wheat-M, *Crop production, Soil-water-plant relationships, *Indoleacetic acid.

Pot experiments demonstrated that on sand with a low moisture content (30% of capillary water absorption capacity), IAA increased the grain and total yields of the spring wheat cultivars 'Nagradowicka' and 'Opolska' and the spring barley 'Browarny PZHR'. The low moisture content of sand usually reduced the weight of 1000 seeds, while an IAA addition increased it slightly.—Copyright 1972, Biological Abstracts, Inc.
W72-11021

CHANGES IN INDOLEACETIC ACID OXIDASE ACTIVITY ASSOCIATED WITH PLANT WATER POTENTIAL, Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research. For primary bibliographic entry see Field 021. W72-11022

COMPARISON OF TILLAGE AND CHEMICAL SUMMERFALLOW IN A SEMIARID REGION, Department of Agriculture, Swift Current (Saskatchewan). Research Station.

C. H. Anderson.
Can J Soil Sci. Vol 51, No 3, p 397-403. 1971. Illus.
Identifiers: Aggregation, Conservation, *Cultivation, Erodibility, Fallow, *Soil treatment, *Herbicides, Soil moisture, Semiarid climates, Summer, Temperature, Tillage, Wheat-M.

Chemical treatments using contact and systemic herbicides were compared with cultivation for summerfallow preparation on a Wood Mountain clay loam soil from 1964 to 1969, inclusive. Use of chemical alone was equal to cultivation in its effect on soil moisture conservation, soil temperature and yield of wheat. Summerfallow prepared by chemical only conserved 62% of the original crop residue, compared with 35% for normal cultivated fallows. Chemically prepared fallows were less erodible (fewer soil particles greater than 1 mm in diameter) at the completion of tillage in the autumn than cultivated fallows. However, the chemically fallowed soils exhibited the least aggregation over winter and were slightly more erodible by spring than the cultivated soils. The general trend was for lower NO₃-N values in the fall and prior to seeding in the spring for wholly chemical than for wholly cultivated summerfallow, but the differences were not usually significant.—Copyright 1972, Biological Abstracts, Inc.
W72-11024

GROWING SEASONS AND THE CLIMATIC MOISTURE INDEX, Department of Agriculture, Ottawa (Ontario). Plant Research Inst. W. K. Sly, and W. Baier. *Can J Soil Sci.* Vol 51, No 3, p 329-337. 1971. Identifiers: Air, Climate, Deficits, *Growing seasons, Irrigation, *Climatic moisture index, Precipitation, Relationships, Soils, Temperature.

Climatic moisture indices for a fixed growing season, from May to Sept., are compared with those for growing seasons defined as the periods when either the mean air temperature in the screen or the soil temperature at a 50-cm depth exceeds 5 deg. C. Indices for the longer growing seasons based on soil and air temperatures have small differences at individual stations, but are larger than those for the May-Sept. period. When arranged according to increasing index values, the orders of the stations are essentially the same when growing seasons are based on soil and air temperatures. These differ from the May-Sept. order only in cases where late spring and early fall rains are heavy in relation to summer precipitation. Indices based on data for the May-Sept. period adequately describe the water demand-water supply relationships during the period in which water deficits develop. When moisture conditions outside the May-Sept. period are needed the accumulated water surpluses should be considered.—Copyright 1972, Biological Abstracts, Inc.
W72-11025

STOMATAL RESISTANCE, TRANSPERSION, AND RELATIVE WATER CONTENT AS INFLUENCED BY SOIL MOISTURE STRESS, Institute for Research on Natural Resources, Abu-Ghraib (Iraq).

T. A. Al-Ani, and J. F. Bierhuizen.
Acta Bot Neerl. Vol 20, No 3, p 318-326. 1971. Illus.
Identifiers: Bean D, Cucumber D, Heat, *Moisture stress, Pressure, Relationships, Resistance, Soils, Stomata, Stress, Tomato D, Transpiration, *Soil-water-plant relationships.

The effect of increasing soil moisture stress on stomatal resistance, transpiration, and relative water content of cucumber, beans and tomato has been investigated under controlled conditions. Stomatal resistance can be used as a tool by which the soil-water-plant relationship can be predicted. Transpiration rates exhibited an initial rise as the soil moisture decreased, followed by a steady reduction. No significant changes in the relative water content of the leaves were observed until a severe soil moisture stress took place. For each

species a linear relationship was obtained between the stomatal diffusive resistance (*r_s*) and the ratio of the vapor pressure difference between leaf surface and bulk air over transpiration. The external resistances to water vapor (*r_a*) obtained from the relationship were 7.2, 4.4 and 2.8 sec cm⁻¹ for cucumber, tomato and bean leaves, respectively. An essentially linear relationship was obtained between *r_s* and viscous air flow. The intercellular resistance (*r_i*) obtained from extrapolation of the curves, were 12.0, 8.7 and 6.6 sec cm⁻¹ for cucumber, bean and tomato, respectively. The external resistance calculated from the sensible heat transfer is well below *r_a* values in all species. The relatively high values of *r_a* and *r_i* have been discussed.—Copyright 1972, Biological Abstracts, Inc.
W72-11027

THE EFFECTS OF WATER STRESS ON SOME MEMBRANE CHARACTERISTICS OF CORN MITOCHONDRIA, Illinois Univ., Urbana. Dept. of Agronomy. R. J. Miller, D. T. Bell, and D. E. Koeppe. *Plant Physiol.* Vol 48, No 2, p 229-231. 1971. Identifiers: Alterations, Calcium, Corn M, Integrity, Ions, *Membranes, Mitochondria, Permeability, Phosphates, Respiration, *Moisture stress, Uptake, Zea mays M.

The reaction of mitochondria isolated from the shoots of water deficient corn plants (*Zea mays* M) was studied. Water stress has a marked effect on the membranes of mitochondria separated from stressed corn. Alterations in membrane integrity are evident from the changes in passive swelling and the lack of contraction after the addition of NADH. Inorganic phosphate seemed to re-establish selective permeability to the membranes of mitochondria isolated from water-stressed plants. Changes in membrane integrity were also noted in experiments in which Ca was added to the reaction media. The oxidation of NADH in the presence of Ca²⁺ by mitochondria isolated from plants of lowered water potential resulted in an uptake of ions rather than the unexpected efflux pumping of ions. As the membrane characteristics changed with increasing stress, there was a corresponding decrease in the rate of respiration, but a cause and effect relationship has yet to be established. Water stress has a pronounced effect on the membranes of mitochondria even though these were *in vitro* experiments. It is likely that the characteristics of the *in vivo* mitochondria could be altered in ways similar to those reported.—Copyright 1972, Biological Abstracts, Inc.
W72-11028

CONTROL OF WATER SUPPLY IN PLANTS AND EVALUATION OF THEIR DROUGHT-RESISTANCE BY THE AUXANOGRAPHIC TECHNIQUE, Belorussian Agricultural Academy, Gorkii (USSR). V. S. Shevelukha. *Fiziol Rast.* Vol 18, No 1, p 147-157. 1971. Illus. English summary. Identifiers: Auxanographic, Barley-M, Control, Deficiency, Drought, Growth, Humidity, Irrigation, Maize-M, Plants, Potato-D, Rate, Resistance, Soil, Technique, Temperature, Water, Wheat-M.

The growth of maize, barley, winter and summer wheat, potato and other plants was studied in vegetative, laboratory and field laboratory experiments by the auxanographic technique under changing conditions of soil humidity. With soil water deficiency plant growth accelerated even 1-60 min after irrigation. The latent period was the longer the lower the initial humidity of soil and air, the lower the growth rate and temperature and the stronger the sun. Growth accelerated with a decrease of the initial soil humidity and with an increase of temperature. The growth response to irrigation was detected only in the plants growing on loamy soil when its humidity was lower than 50%

WATER QUANTITY MANAGEMENT AND CONTROL—Field 04

Control of Water on the Surface—Group 4A

total water capacity. No plant growth was registered at 20% humidity. The critical humidity level, when the length of the latent period and the intensity of the growth reactions change sharply, is 30% of the total water capacity. The growth response of the plants to irrigation was found specific for species and varieties. After irrigation the latent period was much shorter and the growth response more intensive in the drought resistant cultivar of summer wheat 'Saratovskaya 29' than in the less drought-resistant cultivar 'Minskaya.' The growth response of the plants to changing humidity of the environment was shown to be a stable index of their water supply. The auxanographic technique is recommended for the control of plant water supply and for the evaluation of their drought-resistance.—Copyright 1972, Biological Abstracts, Inc.

W72-11030

THE EFFECT OF WATER:SOIL RATIOS ON QUANTITY AND CONCENTRATION OF ELEMENTS IN THE SOLUTION PHASE IN NON-SALINE SOILS AND ITS SIGNIFICANCE IN PLANT NUTRITION,
Soil and Irrigation Research Inst., Pretoria (South Africa).
For primary bibliographic entry see Field 02G.
W72-11032

WATER ACTIVITY IN THE LEAF CELLS: INDICATOR CHARACTERIZING THE WATER SUPPLY OF PLANTS,
Sofia Univ. (Bulgaria). Faculty of Biology.
G. Kimenov.

Rastenievod Nauki. Vol 8, No 2, p 11-19. 1971. English summary. Illus.
Identifiers: *Cell suction capacity, Coefficients, Indicator, *Irrigation, Leaves, Maize M, Plants, Soil, Soil-water-plant relationships.

The state of the tissue water exchange in the leaves and the effect of the soil dryness on the productivity of the double cross interline maize hybrids 'VIR-42' and 'Kansas-1859' grown at 80%, 60% and 40% humidity of the field capacity were studied. The limiting factor for the state of the tissue water exchange is soil humidity. The cell suction capacity, expressed in units of water activity, is manifested most strongly at 40% soil moisture of the field capacity. The daily variations of the cell suction capacity are biggest at such percent of soil humidity. With utilization of the cell suction capacity in irrigation farming its daily variations should be considered as well as the presence of protoplast suction capacity. After the 8-9 leaf phase maize needs soil humidity of 80% of field capacity. The ratio weakly-bound:strongly-bound water can be used as the indicator of the maize water supply characterized as coefficient of the water activity.—Copyright 1972, Biological Abstracts, Inc.

W72-11033

INFLUENCE OF PHOTOPERIOD AND WATER SUPPLY ON PRODUCTION OF SEED AND DRY MATTER IN THREE VARIETIES OF SOYBEAN, GLYCINE MAX (L.) MERR,
Centro de Investigaciones Agronomicas, Maracay (Venezuela).
O. Aquino, and G. P. Makkink.
Neth J Agric Sci. Vol 19, No 3, p 168-175. 1971. Illus.
Identifiers: Dry matter, Glycine Max D, Photoperiod, Photosynthesis, Production, Seeds, *Soybean-D, Varieties, *Consumptive use.

The relationships between seed production and dry matter production, and between dry matter production and water consumption were studied for 3 varieties of soybean under 2 daylength regimes in a greenhouse experiment. Separately the photosynthetic rate was determined under 4 light intensities. No significant differences were found between the cultivars 'Pennsoy', 'L.Z.' and 'Improved Pelican'.—Copyright 1972, Biological Abstracts, Inc.

W72-11038

A STUDY OF THE EFFECTS OF SOIL MOISTURE STRESS AND FERTILITY LEVELS ON HYDROCYANIC ACID FORMATION IN SORGHUM,
Punjab Agricultural Univ., Hissar (India). Dept. of Soils.
S. K. Verma, and I. P. Abrol.
J Indian Soc Soil Sci, Vol 19, No 1, p 1-4. 1971.
Identifiers: *Cyanide, Cyanide, *Soil moisture, Nitrogen, Phosphate, *Sorghum-Vulgare-M, Stress, *Fertilization.

Pot culture studies were conducted to determine the effect of different levels of N, P and soil moisture regimes on the hydrocyanic acid content of Sorghum vulgare Pers. (cv. 'J.S. 263') grown in sandy loam soil deficient in available P. Significant differences in hydrocyanic acid content developed in plant tops that received different levels of N. High (80 kg/ha) and medium (40 kg/ha) levels of N when associated with either low (no added P) or medium (20 kg/ha) levels of P2O5 caused significant increase in HCN content after 35 days of sowing, i.e., before heading as compared to low N (as added N) and high P2O5 levels (40 kg/ha). High levels of P2O5 (40 kg/ha) tended to limit the production of cyanide regardless of the associated levels of N. There was no consistent response to soil moisture regimes.—Copyright 1972, Biological Abstracts, Inc.

W72-11046

WATER SUPPLY AND COTTON PRODUCTIVITY (IN RUSSIAN),
Akademiya Nauk Uzbeckskei SSR, Tashkent. Inst. of Experimental Plant Biology.
K. S. Samiev, E. E. Uzenbaev, and U. S. Sidikov. S-Kh Biol, Vol 6, No 2, p 298-301. 1971.
Identifiers: *Cotton-D, Productivity, *Crop rotation, *Soil moisture.

When cotton type '152-f' was watered during flowering at soil moisture of 70% of field water capacity (f.w.c.), there was an increase in leaf surface area and the general biomass, but a decrease in the number of pods and general yield of raw cotton. At a moisture of 60% of f.w.c. during the same growth period, the plants were of normal size, and there was an increase in the yield of raw cotton. A decrease in the plant size and yield also occurred at a soil moisture of 50% f.w.c.—Copyright 1972, Biological Abstracts, Inc.

W72-11048

CONSUMPTIVE USE OF WATER BY MAIZE GROWN ON LEACHED CINNAMON FOREST SOIL IN THE REGION OF THE STARAZAGORA IRRIGATION SYSTEM, (IN BULGARIAN),
Institute of Water Engineering Land Improvement, Sofia (Bulgaria).
A. Raicheva-Mehandieva.
Rastenievod Nauki. Vol 8, No 3, p 45-55. 1971. Illus. English summary.

Identifiers: Bulgaria, Daily, Forests, Growth, *Irrigation, Leached soils, *Maize M, Starazagora.

Field experiments were conducted on leached cinnamon forest soil in order to establish the irrigation requirement for maize. The total and mean daily consumptive use of water of the crop were established. The values of the biological coefficient R were also determined. Consumptive use of water by maize grown on this soil type ranges from 480 to 517 m³/0.10 ha for treatment 80-80% of field capacity and from 460 to 525 m³/0.10 ha for treatment 80-80-65% of field capacity. Mean daily consumptive use of water varies within broad limits, reaching up to 7.44 m³/0.10 ha, and was highest from tasseling to darkening of the silk. The mean value of the biological coefficient R for the period under study was 0.46.—Copyright 1972, Biological Abstracts, Inc.

W72-11063

EFFECTS OF TREATMENT PLANT EFFLUENT ON SOIL PROPERTIES,
Arizona Agricultural Experiment Station, Tucson. For primary bibliographic entry see Field 05D.
W72-11066

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

STOCHASTIC HYDRAULICS.
For primary bibliographic entry see Field 08B.
W72-10457

A METHOD FOR FLOW COMPUTATION IN FLOOD PLAIN CHANNELS,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 08B.
W72-10459

FOURWING SALTBUCK REVEGETATION TRIALS IN SOUTHERN ARIZONA.
Forest Service (USDA), Tucson, Ariz. Rocky Mountain Forest and Range Experiment Station. For primary bibliographic entry see Field 03B.
W72-10513

A NEW APPROACH TO ESTIMATING HERBAGE MOISTURE CONTENT,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station. G. T. Turner.
Journal of Range Management, Vol. 25, No. 3, p 229-231, May 1972. 1 fig, 2 tab, 4 ref.

Descriptors: *Moisture content, *Grasslands, *Regression analysis, *On-site data collections, Semiarid climates, Colorado, Plant types, Soil-water-plant relationships, Ranges, Range management.

Moisture content is an important but generally neglected attribute of range vegetation. Since it must be eliminated before herbage production can be expressed in terms of dry weight, important variations in herbage moisture content should be recognized. Measurements may be facilitated by the fact that moisture content of plants growing under generally similar conditions is closely interrelated and may be predicted from the content of 1 or more associated species. Herbage samples of 11 species were collected for moisture determination from a southwestern Colorado grassland. The moisture contents of all species were highly correlated and the development of appropriate regression equations made moisture content prediction possible. The species from which predictions are made should be relatively abundant and widely distributed on the site sampled and their moisture content should be sensitive to changes in growing conditions and plant maturity. Whether prediction equations developed for one locality may be used for another is not yet known. Much work remains to be done on this technique. (Casey-Arizona)
W72-10514

LAND USE IN WAH WAH AND PINE VALLEYS, WESTERN UTAH,
Brigham Young Univ., Provo, Utah. Dept. of Botany; and Brigham Young Univ., Provo, Utah. Dept. of Range Science; and Brigham Young Univ., Provo, Utah. Center for Environmental Studies.
J. R. Murdock, and S. L. Welsh.
BYU Science Bulletin, Biological Series, Vol. 12, No. 4, 25 p, January 1971. 35 fig, 25 ref.

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control of Water on the Surface

Descriptors: *Arid lands, *Range management, *Land use, *Vegetation effects, *Grazing, Wildlife management, Pinyon pine trees, Juniper trees, Shrubs, Xerophytes, Water holes, Water resources development, Soil erosion, Utah, Great Basin, Climatic data.

Identifiers: *Overgrazing, *Range degradation.

Wah Wah and Pine Valleys, located in western Utah, near the southeastern portion of the Great Basin, are desert grasslands bordered by mountain ranges. The climate of the region is characterized by temperature extremes, strong drying winds, scanty rainfall and winter snow in the mountains. Vegetation is the Northern Desert Shrub Biome type, which blends and interfingers with juniper-pinyon communities at higher elevations. The public lands of the valleys have been grazed since 1870, and evidence indicates the stocking was excessive for at least 30 years prior to the Taylor Grazing Act of 1934. The unfortunate consequences of this include the reduction of total plant cover, decrease of high quality grazing plants and their replacement by weedy and poisonous plants and the downward movement of pinyon and juniper. Accelerated soil erosion is also much in evidence. The Bureau of Land Management, who inherited this badly abused range, has initiated and carried forward remedial programs. As a result of adjudication in the 1950's and 1960's, overstocking has been eliminated by large animal-unit months cuts. The clearing and reseding of over 14,500 acres of juniper-pinyon woodland combined with other practices, has generated a general improvement in the vegetation resource base. Problems remain. There is a shortage of professional management personnel, vegetation around water holes is in poor condition due to crowding and there is need for closer cooperation between federal, state and county agencies. (Casey-Arizona)
W72-10515

FINAL REPORT: AUTOMATIC DOWNSTREAM CONTROL SYSTEMS FOR IRRIGATION CANALS,
California Univ., Berkeley. Hydraulic Engineering Lab.
For primary bibliographic entry see Field 08C.
W72-10526

PURUKOHUKOHU, IHD EXPERIMENTAL BASINS NOS 4 AND 5, TO 1969.

New Zealand Ministry of Works Hydrological Research Annual Report No 19, 1971. 18 p, 7 fig, 2 tab, 6 ref, append.

Descriptors: Hydrology, *Soil-water-plant relationships, *Hydrologic data, *Data collections, *Watershed management, Rainfall, Runoff, Vegetation, Land use, Streamflow, Flow measurements, Water balance, Water resources development, Water yields, Land development, Topography, Trees, *International Hydrological Decade, *Networks.

Identifiers: *New Zealand, *Purukohukohu basin.

Under the auspices of the International Hydrological Decade the Ministry of Works is establishing a network of experimental basins to study the hydrological characteristics of important soil and vegetation complexes of New Zealand. The Purukohukohu basin is situated 10.5 kilometers due west of Reporoa, 40 kilometers south of Rotorua and 40 kilometers north of Taupo. The basin has an area of 100 hectares and is the western end of the Mangakara representative basin which discharges into the Waikato River system. Data collected from catchments provide information on the effect of land use and/or land management on the hydrology of typical soil/vegetation complexes. Purukohukohu is a combination of two of 19 IHD basins proposed to provide data for such a model. (Woodard-USGS)
W72-10654

QUANTITATIVE ANALYSIS OF DRAINAGE NETWORKS,
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
For primary bibliographic entry see Field 02E.
W72-10705

their relation to system rivers are discussed, and an interpretation of the Wild and Scenic Rivers Act and guidelines in relation to system rivers is presented. (Woodard-USGS)
W72-10897

MODEL TO PREDICT MEAN ANNUAL WATERSHED DISCHARGE,
Federal Highway Administration, Washington, D.C.
For primary bibliographic entry see Field 02A.
W72-10724

FREQUENCY SPECTRUM ANALYSIS OF THE OLD RIVER CONTROL STRUCTURE VIBRATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W72-10920

ROLE OF ECONOMICS IN PLANNING FLOOD PLAIN LAND USE,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
For primary bibliographic entry see Field 06B.
W72-10782

FOREST LITTER AND ITS MOISTURE-RETENTION CAPACITY IN AN OAK FOREST,
B. L. Velichko.
Tr Khar'K S-Kh Inst. Vol 86, No 123, p 118-122. 1969.
Identifiers: *Forest litter, Linden D, Maple D, *Moisture, Oak D, Pine G, USSR, Forests.

DEEP TUNNELS IN HARD ROCK.
Wisconsin Univ., Milwaukee. Coll. of Applied Science and Engineering.
For primary bibliographic entry see Field 05G.
W72-10834

Studies were made of the forest litter in a fresh oak forest in the Sumy Region (of the fertile 'dubrava' type) with linden and maple, including natural and planted stands on slopes. The quantity of forest litter formed in the planted stands (55-60 yr old) was larger than in the natural stands. The quantity of litter was much smaller on steeper slopes. The water-retention capacity was greatest in the decomposed and semidecomposed litter fractions. Mineralization of forest litter proceeded more rapidly in planted stands, with a favorable effect on water-retention capacity. In fresh oak forests on the Left Bank Ukrainian forest steppe (with respect to the Dnieper), the better water and soil conservation properties are found in oak stands with maple and with pine. --Copyright 1972, Biological Abstracts, Inc.
W72-11008

THE IMPACT OF THE DEEP TUNNEL PLAN ON WATER RESOURCES IN THE CHICAGO AREA,
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 05G.
W72-10838

THE POTENTIAL OF PUMPED STORAGE FOR HYDRO-ELECTRIC GENERATION IN MULTI-LEVEL DEEP TUNNEL SYSTEMS,
Harza Engineering Co., Chicago, Ill.
For primary bibliographic entry see Field 05G.
W72-10839

A METHODOLOGY STUDY TO DEVELOP EVALUATION CRITERIA FOR WILD AND SCENIC RIVERS, REPORT OF FOREST SUB-PROJECT,
Idaho Univ., Moscow. Water Resources Research Inst.

J. R. Herbst.
Available from the National Technical Information Service as PB-210 755, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, January 1972. 52 p, 2 fig, 2 graph, 6 map, 9 tab, 25 ref. WRR B-014-IDA (13).

NATURAL REGENERATION OF DOUGLAS FIR AND WHITE FIR ON EXPOSED SITES IN THE SIERRA NEVADA OF CALIFORNIA,
Cloquet Forest Research Center, Minn.

J. C. Tappeiner, II., and J. A. Helms.
Am Midl Natu. Vol 86, No 2, p 358-370. 1971.
Identifiers: *Revegetation, Abies concolor G, California, Carpet-D, Ceanothus prostratus D, Douglas fir G, Environment, *Fir G, Growth, Light, Moisture, Mortality, Pseudotsuga menziesii G, Sierra Nevada (Calif), Sites, Soils.

First- and 2nd-year survival and height growth of naturally regenerated white fir (*Abies concolor*) and douglas fir (*Pseudotsuga menziesii*) seedlings were studied in typical microenvironments on exposed slopes and ridge tops at an elevation of 1300 m in the Sierra Nevada of California. Microsites were described by measuring soil moisture at several depths and potential evaporation at first-year seedling height. Seedlings survive the summer drought apparently by attaining a type of dormancy in a suitable microsite. Survival was greatest in part shade and in full sun providing squaw carpet (*Ceanothus prostratus*) mats were present. In these microenvironments soil moisture reaches tensions of 15 atm and greater, but the reduced potential evaporation at the seedling tops probably compensates for the lack of soil moisture. The growth of natural regeneration is initially quite slow; however, mortality is essentially over by the second year after germination. The all-age group structure of the mixed conifer stands on these sites is apparently related to the occurrence of microenvironments suitable for seedling establishment. --Copyright 1972, Biological Abstracts, Inc.
W72-11035

CIBECUE RIDGE JUNIPER PROJECT,
Geological Survey, Tucson, Ariz.
For primary bibliographic entry see Field 03B.
W72-11086

WATER QUANTITY MANAGEMENT AND CONTROL—Field 04

Groundwater Management—Group 4B

ANNUAL COMILATION AND ANALYSIS OF HYDROLOGIC DATA FOR HONEY CREEK, TRINITY RIVER BASIN, TEXAS, 1970.
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02E.
W72-11087

POTENTIAL TRANSPORT OF SEDIMENT FROM ENLOE RESERVOIR BY THE SIMIL-KAMEEN AND OKANOGAM RIVERS, WASHINGTON,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 02J.
W72-11088

4B. Groundwater Management

GROUNDWATER OF SIBERIA AND THE SOVIET FAR EAST (POZEMNNYE VODY SIBIRI I DAL'NEGO VOSTOKA).

'Nauka', Moscow, 1971. 248 p.

Descriptors: *Hydrogeology, *Structural geology, *Groundwater, *Groundwater resources, Groundwater basins, Aquifers, Rocks, Inorganic compounds, Metals, Trace elements, Gases, Water properties, Water types, Water chemistry, Geochemistry, Hydrothermal studies, Natural resources, Exploration, Investigations, Conferences.

Identifiers: *USSR, *Siberia, *Soviet Far East, *Paleohydrogeology, *Hydrogeochemistry, Hydrosphere, Cryosphere, Groundwater provinces, Artesian basins, Mineralization.

This collection of 38 papers contains reports presented at the Conference on Groundwaters of Siberia and the Soviet Far East, held in Tyumen' in September 1967. Besides basic problems in present-day hydrogeology, attention is focused on the paleohydrogeology, dynamics, geochemistry, and formation of mineral waters and on the hydrogeology of oil, gas, and mineral deposits. Groundwater resources are examined in connection with their effective exploitation and use by different branches of the national economy. (See W72-10441 thru W72-10449) (Josefson-USGS)
W72-10440

RESULTS AND PROBLEMS OF STUDYING INDUSTRIAL MINERAL WATERS OF SIBERIA AND THE SOVIET FAR EAST (TOGI I OCHEREDNNYE ZADACHI IZUCHENIYA MINERAL'NYKH PROMYSHLENNYKH VOD SIBIRI I DAL'NEGO VOSTOKA),
Vsesoyuznyi Geologicheskiy Institut, Leningrad (USSR).

I. K. Zaytsev.
In: Podzemnye vody Sibiri i Dal'nego Vostoka; 'Nauka', Moscow, p 7-13, 1971. 4 ref.

Descriptors: *Hydrogeology, *Structural geology, *Artesian aquifers, *Mineral water, *Industrial water, Groundwater, Confined water, Percolating water, Connate water, Freshwater, Saline water, Brines, Water chemistry, Hydrodynamics, Geologic time, Mapping, Distribution patterns.
Identifiers: *USSR, *Siberia, *Soviet Far East, Platforms, Mineralization.

Formation and distribution of industrial mineral waters in thermohydrodynamic zones of hydrogeologic structures in Siberia and the Soviet Far East are examined. Three areas of artesian waters in Eastern and Western Siberia and along the coast of the Sea of Okhotsk are identified and described together with intermountain artesian basins of fold regions and bodies of interstitial-vein groundwaters. Two hydrodynamic groundwater zones in artesian basins are distinguished: (1) an upper zone of percolating water; and (2) a lower zone of saline water and brines of seas, lagoons, and other water bodies of early geologic age. Plans are outlined for a more detailed investigation of the formation and distribution of

these waters within the vast expanses of land described. (See also W72-10440) (Josefson-USGS)
W72-10441

GROUNDWATER RESOURCES OF SIBERIA AND THEIR ROLE IN THE NATIONAL ECONOMY (RESURSY PODZEMNYKH VOD SIBIRI I IKH ROL' V NARODNOM KHOZYAYSTVE),
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
N. I. Plotnikov.

In: Podzemnye vody Sibiri i Dal'nego Vostoka; 'Nauka', Moscow, p 14-19, 1971. 3 tab, 6 ref.

Descriptors: *Hydrogeology, *Areal hydrogeology, *Groundwater, *Groundwater resources, *Groundwater basins, Aquifers, Artesian aquifers, Freshwater, Industrial water, Mineral water, Water supply, Permafrost, Investigations. Identifiers: *USSR, *RSFST, *Siberia, *Soviet Far East, Platforms, Geosynclines, Taliks, Balneology.

As of January 1, 1967, the volume of fresh groundwater in Siberia and Soviet Far Eastern areas was 20% of the total known groundwater reservoir in the RSFSR. Among the aquifers in Siberia and the Soviet Far East, 61% of the usable groundwater was in sandy-gravel formations of river valleys, 7% in artesian basins of platforms, 29% in artesian basins of geosynclines, and 3% in unfrozen layers within the permafrost (taliks). Fresh groundwater for industrial purposes was used at the rate of 871.0 thousand cu m/day, while mineral water was used at the rate of 10.86 thousand cu m/day. Fresh groundwater for use in industry is recommended together with expanded research to augment mineral-water supplies for therapeutic application. (See also W72-10440) (Josefson-USGS)
W72-10442

BASIC PROBLEMS IN HYDROGEOLOGY (OSNOVNNYE PROBLEMY GIDROGEOLOGII),
Moskovskii Geologorazvedochnyi Institut (USSR).
For primary bibliographic entry see Field 02F.
W72-10443

BASIC PATTERNS IN THE ACCUMULATION OF IODINE, BROMINE, BORON, STRONTIUM, POTASSIUM, BARIUM AND OTHER TRACE ELEMENTS IN DIFFERENT TYPES OF INDUSTRIAL WATER (OSNOVNNYE ZAKONOMERENIYA NAKOPLENIYA YODA, BROMA, BORA, STRONTSIYA, K ALIYA, BARIYA I DRUGIKH MIKROELEMENTOV V RAZLICHNYKH TIPAKH PROMYSHLENNYKH VOD),
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 02F.
W72-10444

THE TYUMEN' DEPOSIT OF INDUSTRIAL THERMAL WATER (TYUMENSKOE MESTOROZHDENIYE PROMYSHLENNYKH TERMAL'NYKH VOD),
Tyumen'skiy Geologorazvedochnyi Trest (USSR).
N. V. Mizina, L. M. Kravchenko, V. L. Nedochetova, and N. P. Lyaduk.
In: Podzemnye vody Sibiri i Dal'nego Vostoka; 'Nauka', Moscow, p 125-128, 1971. 1 fig.

Descriptors: *Hydrogeology, *Structural geology, *Water types, *Thermal water, *Industrial water, Groundwater, Water temperature, Water chemistry, Salts, Halogens, Gases, Pressure, Discharge (Water), Specific capacity, Aquifers, Boreholes, Exploration, Investigations.
Identifiers: *USSR, *Siberia, *Tyumen' Oblast, Mineralization.

The Tyumen' industrial thermal-groundwater deposit, located in the southwestern part of the West Siberian Lowland and covering more than 60,000 sq km, was discovered in 1956-57 and investigated in 1961-64. In size and volume of industrial water, the deposit is the largest in the USSR. Prospecting for industrial-water supplies at the Tobol'skaya and Cherkashinskaya boreholes is complete but is continuing in the Sergeyevskaya area 70 km north of Tobol'sk. A number of promising areas in the deposit are being designated for exploratory work. Basic characteristics of the deposit's geological structure are examined in conjunction with problems dealing with water content of the principal aquifer in the region and the chemical composition, gas saturation, and temperature conditions of the groundwater. (See also W72-10440) (Josefson-USGS)
W72-10445

MINERAL WATERS OF THE SIBERIAN PLATEAU (MINERAL'NYYE VODY SIBIRSKOY PLATOFORMY),
For primary bibliographic entry see Field 02F.
W72-10446

MINERAL WATERS IN THE NORTHWESTERN PART OF THE KANSK ARTESIAN BASIN (MINERAL'NYYE VODY SEVERO-ZAPADNOY CHASTI KANSKOGO ARTEZIANSKOGO BASSEYNA),
Irkutskii Gosudarstvennyi Universitet (USSR).
For primary bibliographic entry see Field 02F.
W72-10447

FORMATION OF THE CHEMICAL COMPOSITION OF WATERS OF SOME MINERAL SPRINGS IN EASTERN SAYAN (O FORMIROVANII KHMICHESKOGO SOSTAVА VOD NEKOTORYKH MINERAL'NYKH ISTOCHNIKOV VOSTOCHNOGO SAYANA),
Irkutskii Gosudarstvennyi Universitet (USSR).
For primary bibliographic entry see Field 02F.
W72-10448

MINERAL WATERS OF THE CHITA OBLAST (MINERAL'NYYE VODY CHITINSKOY OBLASTI),
Chitinskoe Geologicheskoe Upravlenie (USSR).
For primary bibliographic entry see Field 02F.
W72-10449

WATER FOR SOUTHERN NEVADA: PART 1,
Montgomery (James M.) Consulting Engineers, Inc., Pasadena, Calif.
E. L. Kostjal, F. K. Duren, and A. Morgner.
Water and Sewage Works, May 1972, p 106-117, Vol 119, No 5, May 1972. 5 fig, 2 tab, 8 ref.

Descriptors: *Water resources development, *Projections, *Nevada, *Water supply, *Water demand, Surface waters, Groundwater, Forecasting, Water balance, Hydrologic budget, Reviews, Evaluations, Economic feasibility, Costs.

Projection of water use trends and population growth rates in Las Vegas indicate that a water shortage will occur near the turn of the century. There are several alternative supplies which can be developed. Some involve transporting water across state boundaries and consequently cannot be implemented unilaterally by Nevada. Supplies located in Nevada require the mining of groundwater. Developing these sources will increase water cost 2.5 times in Las Vegas. If intrastate plans are pursued, non-economic factors must be considered. Farming in the source area would be severely curtailed because agricultural water rights would have to be purchased. In addition, there are significant environmental problems, which will result from lowering the groundwater table, that must be considered. (Woodard-USGS)
W72-10471

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B—Groundwater Management

IRRIGATION DEVELOPMENT IN THE CENTRAL BASIN OF THE OGALLALA FORMATION—THE PAST AND THE FUTURE,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics; and Haile Sellassie I Univ., Alem Maya (Ethiopia). Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W72-10516

GEOTHERMAL RESOURCES IN CALIFORNIA—POTENTIALS AND PROBLEMS,
California Inst. of Tech., Pasadena. Environmental Quality Lab.
For primary bibliographic entry see Field 06G.
W72-10550

ANALYSIS OF THE EFFECT OF POTENTIAL REACTOR COOLING PONDS ON THE HANFORD GROUNDWATER SYSTEM,
 Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
For primary bibliographic entry see Field 05C.
W72-10552

THE NITRATE HAZARD IN WELL WATER, WITH SPECIAL REFERENCE TO HOLT COUNTY, NEBRASKA,
Geological Survey, Lincoln, Nebr.
For primary bibliographic entry see Field 05B.
W72-10591

SEA WATER INTRUSION EXTRACTION BARRIER,
California State Dept. of Water Resources, Los Angeles. Southern District.
For primary bibliographic entry see Field 08A.
W72-10643

WATER RESOURCES AT MARINE CORPS SUPPLY CENTER, BARSTOW, CALIFORNIA FOR THE 1971 FISCAL YEAR,
Geological Survey, Menlo Park, Calif.
J. H. Kochler.
Geological Survey Open-file Report, February 8, 1972. 18 p, 4 fig, 4 tab, 5 ref.

Descriptors: *Water supply, *Water wells, *Basic data collections, *Military reservations, *California, Groundwater, Aquifers, Pumping, Withdrawal, Water yield, Water quality, Chemical analysis, Water level fluctuations, Groundwater recharge.
Identifiers: *Marine Corps Supply Center, Barstow (Calif).

Basic data collected from the water supply for the Marine Corps Supply Center, Barstow, Calif., are presented for the 1971 fiscal year. The water is obtained from wells in the unconsolidated deposits of the Mojave River basin. Recharge to the deposits is mainly from infiltration of streamflow in the Mojave River. The water level in wells in the study area declined between March 1970 and April 1971. In the eastern part the water level declined an average of 1.8 feet. In the western part the decline averaged 4.6 feet. The total pumping at the Marine Corps Supply Center in the 1970 calendar year was 1,854 acre-feet, an increase of about 240 acre-feet from the previous year. None of the chemical constituents in the water samples collected in 1971 from the Yermo supply wells exceeded limits for drinking water recommended by the U.S. Public Health Service (1962). However, the dissolved solids in each of four samples collected from the Nebo supply wells ranged from 554 to 862 mg/liter, exceeding the recommended limit of 300 mg/liter. (Woodard-USGS)
W72-10645

STEADY-STATE WELL-FLOW THEORY FOR A HORIZONTAL CONFINED AQUIFER WITH

ARBITRARY CONDITIONS ON THE OUTER BOUNDARY,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 02F.
W72-10647

WATER WELL AND GROUND-WATER CHEMICAL ANALYSIS DATA, REAGAN COUNTY, TEXAS,
Texas Water Development Board, Austin.
D. A. Muller, and H. E. Couch.
Texas Water Development Board Report 145, April 1972. 58 p, 3 fig, 2 tab.

Descriptors: *Groundwater, *Water wells, *Basic data collections, *Chemical analysis, *Texas, Water quality, Well data, Water levels, Maps, Sites, Locating, Aquifers, Water users.
Identifiers: *Reagan County (Tex), Well inventories.

Groundwater data collected in Reagan County, Texas, in 1966 are tabulated. Reagan County is located in the southwestern part of Texas in the physiographic province known as the Edwards Plateau; covers an area of 1,133 square miles; and ranges in elevation from approximately 2,400 to 2,900 feet above mean sea level. Public officials, landowners, and lessees were contacted to obtain basic information on the well location, depth, and water use, such as domestic, livestock, irrigation, industrial, or public supply. Each well was visited, if possible, to measure the static water level, and water samples from representative wells were collected for chemical analysis. Locations of wells were ascertained by aerial photographs. There were 812 water wells inventoried and 277 water samples collected for chemical analysis. Selected basic data from previously published groundwater reports and other sources have been included for comparison and continuity. The sources of these data are listed. (Woodard-USGS)
W72-10649

WATER WELL AND GROUND-WATER CHEMICAL ANALYSIS DATA, IRION COUNTY, TEXAS,
Texas Water Development Board, Austin.
J. R. Pool.
Texas Water Development Board Report 146, April 1972. 38 p, 3 fig, 2 tab.

Descriptors: *Groundwater, *Water wells, *Basic data collections, *Chemical analysis, *Texas, Water quality, Well data, Water levels, Maps, Sites, Locating, Aquifers, Water users.
Identifiers: *Irion County (Tex), Well inventories.

Groundwater data collected in Irion County during intermittent periods from March 1966 to September 1968 are tabulated. Historical records pertinent to this investigation also are included. Irion County is located in the west-central part of Texas on the northeast edge of the physiographic province known as the Edwards Plateau; covers an area of 1,073 square miles; and ranges in elevation from approximately 2,000 to 2,700 feet above mean sea level. Public officials, landowners, and lessees were contacted to obtain basic information on the well location, depth, and water use, such as domestic, livestock, irrigation, industrial, or public supply. Each well was visited, if possible, to measure the static water level, and water samples from representative wells were collected for chemical analysis. Locations of wells were ascertained by aerial photographs. A total of 474 wells and 4 springs were inventoried, and 201 water samples were collected for chemical analysis. (Woodard-USGS)
W72-10650

HORIZONTAL WATER WELLS (GORIZONTAL'NYYE VODOZABORNNYYE SKVAZHINY),
For primary bibliographic entry see Field 08A.
W72-10656

DEVELOPMENT OF PRESSURE IN GROUND-WATER HORIZONS CAUSED BY STORAGE IN LARGE RESERVOIRS (RAZVITIYE PODPORA V GORIZONTAKH NAPORNYKH VOD PRI SOZDANIIS KRUPNYYKH VODOKHRANILISHCH),
All-Union Research Inst. of Marine Geology and Geophysics, Riga (USSR).
For primary bibliographic entry see Field 02F.
W72-10658

GROUND WATER IN THE TERESINA-CAMPO MAIOR AREA, PIAUI, BRAZIL,
Geological Survey, Washington, D.C.
H. G. Rodis, and E. F. Suszczynski.
Available from GPO, Washington, D.C. 20242. Price \$0.30. Geological Survey Water-Supply Paper 1663-G, 1972. 2 fig, 1 plate, 4 tab, 25 ref.

Descriptors: *Water resources development, *Groundwater, *Data collections, Basic data collections, South America, Hydrogeology, Water yield, Aquifer characteristics, Withdrawal, Water quality.
Identifiers: *Teresina (Brazil), *Brazil.

The Teresina-Campo Maior area lies in a presently developing farming and grazing region near the margin of drought-prone northeast Brazil. Irrigated farming offers the best potential for economic development. The climate is hot and humid most of the year but with distinct wet and dry seasons. Temperature extremes range from 20 deg C to 39 deg C and the annual rainfall averages 1,200 millimeters. The area's groundwater reservoir is contained chiefly in sandstone aquifers of six westward-dipping sedimentary rock formations. There are in the report area about 200 drilled wells most of which are pumped with power-driven engines. The wells range from 40 to 500 meters deep but most do not exceed 150 meters, and practically all are completed without casing. Yields range from 500 liters per day for 6-inch-diameter domestic wells to 240,000 liters per hour for 10-inch high-capacity municipal wells. The current annual withdrawal from the principal aquifers is approximately 5 million cubic meters of which almost half is used for municipal supply and the rest for rural household and irrigation uses. Additional water for public supply is available from aquifers now being pumped, and larger yields probably could be obtained from rural wells designed to take full advantage of the aquifer. The chemical quality of the water is well within the accepted limits of mineral concentration for most uses. The current annual withdrawal from the principal aquifers is less than 0.0025% of a conservative estimate of annual replenishment from rainfall. (Knapp-USGS)
W72-10727

PRELIMINARY HYDROGEOLOGIC APPRAISAL OF NITRATE IN GROUND WATER AND STREAMS, SOUTHERN NASSAU COUNTY, LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
For primary bibliographic entry see Field 05B.
W72-10734

TRAVEL OF POLLUTION-INDICATOR BACTERIA THROUGH THE MAGOTHY AQUIFER, LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
For primary bibliographic entry see Field 05B.
W72-10735

MICROBIOLOGICAL ASPECTS OF GROUND-WATER RECHARGE-INJECTION OF PURIFIED CHLORINATED SEWAGE EFFLUENT,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 05B.
W72-10736

CORROSION OF WELL-CASING AND SCREEN METALS IN WATER FROM THE MAGOTHY

WATER QUANTITY MANAGEMENT AND CONTROL—Field 04

Groundwater Management—Group 4B

AQUIFER AND INJECTED RECLAIMED WATER, BAY PARK, LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
For primary bibliographic entry see Field 05B.
W72-10737

ECONOMIC OPTIMIZATION OF A SINGLE-CELL AQUIFER,
Washington Univ., Seattle. Dept. of Economics.
G. Brown, Jr., and R. Deacon.
Water Resources Research, Vol. 8, No. 3, p 557-564, June, 1972. 3 fig, 12 ref.

Descriptors: *Water quality, *Water treatment, *Aquifers, Surface waters, Artificial recharge, Water table, Algorithms, Mathematical models, Optimization, Net profit, Systems analysis, Groundwater availability, Surface water availability.
Identifiers: Groundwater management, Groundwater withdrawal, Groundwater consumption, Pumping tax, Lift levels.

Optimal economic use of an aquifer of over time is analyzed under conditions of economic growth, inequality of groundwater withdrawal and consumption, and availability of surface water and artificial recharge; the value of an aquifer as a natural water quality treatment facility is derived. These conditions are discussed in depth and presented explicitly as four subject areas that have hitherto remained unexplored. The stage is set with a simple nonstochastic groundwater model using optimal control; equations are plentiful throughout the study. Discussed are optimal lift levels and pumping tax for a groundwater basin characterized by simple growth of the net benefits of water. Second, the model makes explicit the important distinction between groundwater use and consumption: Groundwater users with different rates of return flow should pay different pumping tax rates because they borrow different amounts of capital. Third, it is shown that introducing surface waters or artificial recharge replenishment raises the water table and lowers the pumping tax. And fourth, and explicit distinction is made between water quantity and water quality that permits the determination of the value of a groundwater basin as a natural water quality treatment facility. (Bell-Cornell)
W72-10738

DEVELOPMENT AND DEMONSTRATION OF LOW-LEVEL DRIFT INSTRUMENTATION,
Environmental Systems Corp., Knoxville, Tenn.
For primary bibliographic entry see Field 05G.
W72-10818

EVALUATION OF SALT WATER DISPOSAL INTO POTENTIAL GROUND-WATER RESOURCES,
Oklahoma Corp., Commission, Oklahoma City.
For primary bibliographic entry see Field 05B.
W72-10895

SUBSURFACE HYDRAULICS IN THE AREA OF THE GILA RIVER PHREATOPHYTE PROJECT, GRAHAM COUNTY, ARIZONA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W72-10898

GEOLOGY AND GROUND WATER OF THE MOLALLA-SALEM, SLOPE AREA, NORTHERN WILLAMETTE VALLEY, OREGON,
Geological Survey, Washington, D.C.
E. R. Hampton.

Available from GPO, Washington, DC 20402-Price \$5.25 (includes plates). Geological Survey Water-Supply Paper 1997, 1972. 83 p, 15 fig, 2 plate, 11 tab, 23 ref.

Descriptors: *Hydrogeology, *Oregon, *Water resources development, Aquifer characteristics, Water yield, Water levels, Data collections, Aquifers, Water level fluctuations, Water balance.
Identifiers: *Willamette Valley (Oreg.).

The Molalla-Salem Slope area of the Northern Willamette Valley, Oregon, includes the lower foothills of the Cascade Range and a narrow strip of valley plain of the Willamette Valley. Annual precipitation on the area ranges from about 40 inches in the valley plain to about 80 inches in the foothills. Volcanic and sedimentary rock units exposed in the foothills range in age from Oligocene to Holocene. Most of these units have been penetrated by wells in the valley-plain area, where the older units are overlain by the Willamette Silt and alluvial deposits. The older units of a given rock type generally are less permeable than the younger. In general, water levels in wells in the area fluctuate seasonally. Groundwater occurs under perched, confined, and unconfined conditions, and at most places supplies of water adequate for domestic and stock use can be obtained from wells less than 400 feet deep. Chemical quality of all water is generally excellent and within desirable ranges of hardness and salinity for public supply, industrial, and irrigation uses. Recharge to the groundwater body beneath the valley plain is estimated to be 180,000 acre-feet. Water levels recover each year to the level of the previous year. The quantity of groundwater available for use on a sustained annual basis far exceeds the 12,000 acre-feet pumped for all uses in 1966. (Knapp-USGS)
W72-10899

HYDROLOGIC RECONNAISSANCE OF THE BLUE CREEK VALLEY AREA, BOX ELDER COUNTY, UTAH,
Geological Survey, Salt Lake City, Utah.
E. L. Bolke, and D. Price.
Utah Department of Natural Resources, Salt Lake City, Technical Publication No 37, 1972. 38 p, 5 fig, 1 plate, 6 tab, 15 ref. append.

Descriptors: *Hydrologic data, *Basic data collections, *Surface waters, *Groundwater, *Utah, Water resources, Precipitation (Atmospheric), Aquifers, Water wells, Water yield, Withdrawal, Pumping, Irrigation, Groundwater recharge, Geology, Valleys, Mountains, Water quality, Chemical analysis, Streamflow, Evapotranspiration, Water level fluctuations, Water balance.
Identifiers: *Blue Creek Valley (Utah), *Box Elder County (Utah).

The Blue Creek Valley area includes about 250 square miles in a semiarid, sparsely populated section of northwestern Utah. Normal annual precipitation in the area ranges from about 15 inches on the valley floor to slightly more than 20 inches in the mountains and totals about 184,000 acre-feet. Surface runoff is about 2,200 acre-feet per year. Average annual groundwater recharge and discharge are estimated to be about 14,000 acre-feet each. The largest developed water supply is from Blue Springs. The water is impounded in Blue Creek Reservoir and is used for irrigation. The discharge of Blue Springs is about 7,200 acre-feet per year. The principal chemical types of water in the area are calcium-magnesium chloride and sodium chloride. Concentrations of dissolved solids in the water range from less than 600 milligrams per liter in some wells and mountain springs to about 8,000 mg/liter in the lower Blue Creek. Most of the water contains one or more dissolved constituents that exceed the recommended maximum allowable limits set by the U.S. Public Health Service for drinking water, but most of the water is acceptable for stock use. Water from Blue Springs is used for irrigation, although both the sodium hazard and salinity hazard are very high. (Woodard-USGS)
W72-10900

GROUND-WATER RESOURCES OF THE YUCCA VALLEY-JOSHUA TREE AREA, SAN BERNARDINO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
R. E. Lewis.
Geological Survey Open-file Report, March 24, 1972. 51 p, 15 fig, 8 tab, 33 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Water yield, *Water demand, *California, Projections, Groundwater recharge, Water supply, Water wells, Withdrawal, Hydrologic data, Reviews, Imported water, Water quality, Hydrogeology, Water storage.
Identifiers: *San Bernardino County (Calif.), *Yucca Valley (Calif.), *Joshua Tree area (Calif.).

The southeastern part of the Mojave Water Agency area comprises about 600 square miles in San Bernardino County, California. Groundwater recharge into the area is almost exclusively from precipitation in the San Bernardino and Little San Bernardino Mountains. About 500 acre-feet per year of recharge enters the western part of the area as underflow through Pipes Wash. Little direct recharge occurs as a result of precipitation directly on the unconsolidated deposits. Presently about 11,000 persons reside in the area and current gross pumpage is about 1,600 acre-feet annually. By the year 2000 the population is estimated to be 62,000 and annual gross pumpage is expected to be nearly 11,000 acre-feet. If imported water from northern California is not available before about 1990, additional local supplies will have to be developed, possibly in the adjacent Pipes subbasin to the north. Groundwater in the southern part of the study area generally contains less than 250 mg/liter dissolved solids and 1.0 mg/liter fluoride. A general degradation of groundwater quality occurs northward toward the dry lakes where the concentrations of dissolved solids and fluoride approach 2,000 and 5.0 mg/liter, respectively. (Woodard-USGS)
W72-11070

GROUND-WATER CONTAMINATION—AN EXPLANATION OF ITS CAUSES AND EFFECTS.
Geraghty and Miller, Port Washington, N.Y.
For primary bibliographic entry see Field 05B.
W72-11072

HYDROGEOLOGIC DATA FOR THE NORTHERN HIGH PLAINS OF COLORADO,
Geological Survey, Lakewood, Colo.
For primary bibliographic entry see Field 07C.
W72-11080

GROUNDWATER IN POLK COUNTY, NEBRASKA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-11081

AVAILABILITY AND QUALITY OF GROUND-WATER IN THE ASHLAND QUADRANGLE, JACKSON COUNTY, OREGON,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W72-11082

RECHARGE OF TURBID WATER TO THE OGALLALA AQUIFER THROUGH A DUAL-PURPOSE WELL,
Southwestern Great Plains Research Center, Bushland, Tex.
A. D. Schneider, O. R. Jones, and D. C. Signor.
Texas Agricultural Experiment Station Miscellaneous Paper MP-1001, Texas A and M University, August 1971. 10 p, 6 fig, 3 tab, 13 ref.

Descriptors: *Artificial recharge, *Playas, *Texas, *Recharge wells, *Turbidity, Conjunctive use, Injection wells, Water quality, Aquifer characteristics, Hydrogeology, Aquifer testing, Water yield, Permeability.

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B—Groundwater Management

Identifiers: *Ogallala aquifer (Tex).

The use of irrigation wells for artificial ground-water recharge is proposed as a method for conserving runoff water in playa lakes that is otherwise lost to evaporation. To test this procedure, a gravel-packed, dual-purpose well was completed in an area where the Ogallala Formation is thin and heterogeneous and consists mainly of sand and fine gravel with some silt and clay. During a 21-hour recharge test, turbid playa water containing an average of 600 ppm suspended solids was injected at 150 gpm. Immediately after recharging ended, the well was pumped and surged for 2.1 hours in an attempt to remove the injected silt and clay. The silt and clay recovery was only 20 percent, and the short interval of recharging reduced the specific capacity of the well from 6.0 to 3.8 gpm/ft. The specific capacity recovered to 4.8 gpm/ft, partially because natural recharge increased the thickness of the saturated formation by 7 feet. However, pumping for 9 days did not increase the specific capacity. Without clarification, the playa water is best suited for methods of groundwater recharge in which sediment-laden water is acceptable. (Knapp-USGS)
W72-11084

4C. Effects on Water of Man's Non-Water Activities

CHANGES IN STREAMFLOW FOLLOWING PARTIAL CLEARCUTTING ON A FORESTED WATERSHED,
Pennsylvania Agricultural Experiment Station, University Park.

J. A. Lynch, and W. E. Sopper.
Research Briefs, Pennsylvania State University School of Forest Resources, Vol 4, No 1, p 8-11, Spring 1970. OWRR A-006-PA (17).

Descriptors: *Forest watersheds, *Clear-cutting, *Streamflow, *Water yield, *Pennsylvania, Water quality, Water temperature, Turbidity, Environmental effects, Watershed management, Runoff, Forest management.
Identifiers: Streamflow changes.

Three small forested watersheds in Pennsylvania were calibrated to determine the relationship between the water regimens in undisturbed forest conditions for 8 years. Following this calibration period, 21.3 acres of the lower one-third of Leading Ridge Watershed Two (106 acres) was clearcut during January to April 1967. This clearcut was made to determine the effects of a partial removal of a forest cover on water yield and quality. Average monthly maximum water temperatures during June, July, and August increased an average of 6 F (62F to 68 F) while average monthly water temperatures increased an average of 4 F (59 F to 63 F). Minimum water temperatures showed little change. An increase in annual water yield of 2.7 area-inches resulted during the first year following logging (May 1, 1967 to April 30, 1968). Clearcutting had a variable effect on instantaneous peak flows above 10 cubic feet per second per square mile. Significant increases in maximum peaks (approximately 50%) were observed for 8 out of 20 storms. All of these significant peaks occurred during the growing season and did not represent any potential flood threat. (Woodard-USGS)
W72-10630

MOUTERE, IHD EXPERIMENTAL BASIN NO. 8, 1970.

New Zealand Ministry of Works Hydrological Research Annual Report No. 20, 1971. 18 p, 9 fig, 5 tab, 7 ref, append.

Descriptors: *Soil-water-plant relationships, *Runoff, *Water yield, *Sediment transport, Vegetation, Rainfall, Storms, Land use, Pastures,

Livestock, Hydrologic data, Data collections, *International Hydrological Decade, Watershed management, Water resources development, Water balance, *Networks.
Identifiers: *New Zealand, *Moutere basin.

Under the auspices of the International Hydrological Decade the Ministry of Works is establishing a network of experimental basins to study the hydrological characteristics of important soil and vegetation complexes of New Zealand. This is the fifth annual research report for Moutere. Development of gorse-covered catchments to cultivation doubled the total annual water yield. Peak discharges increased especially for storms producing flood flows in the medium range (1 mm/h). Individual hydrograph studies indicated increases in runoff up to first peak, and decreases in surface detention. Time of overland flow after peak decreased from 25 to 14 minutes. Following burning of the gorse and before line dozing for forestry preparation, sediment samples were taken during a number of storm events to determine the 'before' sediment discharge rating curve. Two differing rating curves, one for increasing stage and one for decreasing stage, were obtained for the 'after' condition. (Woodard-USGS)
W72-10653

SEDIMENT YIELDS OF URBAN CONSTRUCTION SOURCES, MONTGOMERY COUNTY, MARYLAND,
Geological Survey, Parkville, Md.

For primary bibliographic entry see Field 02J.
W72-10719

CONCEPTUAL HYDROLOGIC MODELS FOR URBANIZING BASINS,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.

For primary bibliographic entry see Field 02A.
W72-10723

POPULATION DENSITY AS AN INDIRECT INDICATOR OF URBAN AND SUBURBAN LAND-SURFACE MODIFICATIONS,
Geological Survey, Trenton, N.J.

S. J. Stankowski.
Prof. Paper 800-B available from GPO, Washington, D C 20402 - Price \$2.25. In: Geological Survey Research 1972, Chapter B; U S Geological Survey Professional Paper 800-B, p B219-B224, 1972. 2 fig, 2 tab, 11 ref.

Descriptors: *Urban hydrology, *Land use, *Rainfall-runoff relationships, *Peak discharge, *Population, Urban mapping, Urbanization, Urban runoff, Storm runoff, Suburban areas.
Identifiers: *Population density, *Impervious area.

A new method was developed for determining a quantitative index of urban and suburban land-use characteristics for application in regional water-resources analyses. Population density is the only independent variable needed to estimate empirically the proportion of impervious area resulting from urban and suburban development. This formulation is based on correlations between population density and the proportions of land area in each of six urban and suburban land-use categories. The proportions of land use are weighted by the average percentage of impervious area found in each land-use category. The method is illustrated using county land-use and population-density data for New Jersey. The procedure, though limited by the averaging process, is an inexpensive and rapid technique for generating quantitative indices of land-surface development for use in preliminary and general hydrologic studies and projections. (Knapp-USGS)
W72-10733

WATER YIELD INCREASED FROM PARTIAL CLEARCUTTING OF FORESTED WATERSHED,
Pennsylvania State Univ., University Park. Coll. of Agriculture.

J. A. Lynch, and W. E. Sopper.
Science in Agriculture, Vol 17, No 3, p 8-9, Spring 1970. 8 fig. OWRR A-006-PA (20).

Descriptors: *Forest watersheds, *Clear-cutting, *Water yield, *Vegetation effects, *Pennsylvania, Water quality, Turbidity, Erosion, Sediment transport, Runoff, Streamflow, Water temperature, Small watershed, Watershed management.
Identifiers: Logging (Timber).

The effects of partial removal of vegetative cover on a forested watershed in central Pennsylvania are presented. For 8 years, streamflow on 3 small adjacent forested watersheds was measured to determine the relationships between the water patterns in an undisturbed forest condition. Following this calibration period, 21.3 acres of the lower one-third of the watershed, which occupies 106 acres, was clearcut during the period January to April, 1967. Average monthly maximum water temperatures during June, July, and August increased an average of 6 deg F (62 deg F to 68 deg F). Minimum water temperatures showed little change. Only 8 of a total of 23 storm and non-storm turbidity samples collected during controlled logging exceeded 25 ppm, the limit for drinkable water. An annual water yield of 2.7 inches occurred for the 106-acre watershed during the first year following logging. Most of this increase, 2.3 area inches, occurred during the growing season—particularly July, August, and September. It represents an increase of nearly 7 million gallons of water during the time when the demand for water is greatest and the supply lowest. (Woodard-USGS)
W72-11073

4D. Watershed Protection

SOURCES OF STREAMFLOW IN A SMALL HIGH COUNTRY CATCHMENT IN CANTERBURY, NEW ZEALAND,
Forest and Range Experiment Station, Rangiora (New Zealand).

For primary bibliographic entry see Field 02E.
W72-10473

ENGINEERING METHODS OF CALCULATING AND FORECASTING WATER EROSION (INZHENERNYYE METODY RASCHETA I PROGNOZI VODNOY EROZII),
For primary bibliographic entry see Field 02J.
W72-10655

SEDIMENT CONTROL METHODS: B. STREAM CHANNELS.

American Society of Civil Engineers, New York. Hydraulics Div.
For primary bibliographic entry see Field 08B.
W72-10722

METHOD AND MEANS FOR PLACING ARTIFICIAL SEAWEED,
K. W. Edwards.

U. S. Patent No. 3,648,464, 4 p, 2 fig, 2 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 2, p. 470, March 14, 1972.

Descriptors: *Patents, Beaches, *Erosion control, Sediment transport, *Beach erosion, Shore protection.
Identifiers: *Seaweed, *Artificial seaweed.

A method is described for anchoring artificial seaweed to a particulate floor underneath a body of water. The lower end of a fluid conduit is connected to the anchoring body of seaweed. These are lowered to the floor forcing the fluid through

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Identification of Pollutants—Group 5A

the conduit for discharge under the anchoring body to displace particulate matter from beneath the anchoring body thereby generating a cavity into which the anchoring body settles. (Sinha-OEIS)
W72-10769

SOIL EROSION AND ITS CONTROL BY FOREST STRIPS ALONG GULLIES,
V. M. Pavlov.
(TR) Novocherk Inzh-Melior Inst. Vol 11, No 5, p 78-86. 1969.
Identifiers: *Erosion control, *Forests, Gullies, Forest litter, Permeability, Runoff, Soils, USSR.

Studies were made of the water permeability of soil, runoff and soil erosion by water in erosion-control forest strips and on adjacent lands in the Rostov Region. Soils under the forest strips possessed the highest water permeability and the least runoff. Removal of the forest litter reduced water permeability of soils and caused a sharp increase in runoff.—Copyright 1972, Biological Abstracts, Inc.
W72-11002

SOIL EROSION AND ITS CONTROL IN THE CHERNIGOV REGION,
For primary bibliographic entry see Field 03F.
W72-11003

05. WATER QUALITY MANAGEMENT AND PROTECTION

SA. Identification of Pollutants

REMOTE MEASUREMENT OF POLLUTION.
National Aeronautics and Space Administration, Washington, D.C.
For primary bibliographic entry see Field 05B.
W72-10468

CONCENTRATION FACTORS IN THE AQUATIC ENVIRONMENT,
New York Univ., Medical Center, N.Y. Inst. of Environmental Medicine.
S. M. Jinks, and M. Eisenbud.
Radiation Data and Reports, Vol 13, No 5, p 243-247, May 1972. 2 tab, 42 ref.

Descriptors: *Radiation, *Radiochemical analysis, *Aquatic life, Pollutant identification, Marine plants, Freshwater fish, Marine fish, Water pollution sources, Correlation analysis, Radioisotopes, Ecosystems, Mollusks, Crustaceans, Ecology, Environmental effects.
Identifiers: Radionuclides, Conversion factors, Aquatic organisms.

A review of literature in which concentration factors are reported for the principal nuclides in fresh water and marine organisms indicates wide variability. These data are summarized and the reason for the variability is discussed. The International Laboratory of Marine Radioactivity conducted an intercalibration study which compared measurements by 44 different laboratories of certain radionuclides in sea water. The results show a wide range in the reported values. The ratios of minimum to maximum in the reported values for each nuclide varied from 3.5 for strontium-90 to 570 for zirconium-niobium-95. A previous intercalibration study conducted on an international scale has revealed a similar high degree of variability in stable element analysis by neutron activation and atomic absorption spectroscopy. (Woodard-USGS)
W72-10472

GENERAL NATURE OF SOLUBLE AND PARTICULATE ORGANICS IN SEWAGE AND SECONDARY EFFLUENT,
Geological Survey, Washington, D. C. Water Resources Div.
For primary bibliographic entry see Field 05B.
W72-10478

SULFATE-REDUCING VIBRIONS AND BIOLOGICAL CORROSIONS, (IN FRENCH),
Institut Pasteur, Lille (France). Laboratoire d'-Hydrobiologie.

A. Marcz, E. Tellier, and H. Leclerc.
Ann Inst Pasteur Lille. Vol 22, p 137-176. 1971. English summary.

Identifiers: *Sulfur bacteria, Conduits, *Corrosion, Desulfovibrio, Metal, Vibrions, Potable water.

Properties of sulfate-reducing bacteria (including Desulfovibrio) have not yet been studied in detail in spite of their great importance. Analysis of water emanating from different origins and from metallic conduits was performed to detect the presence of microorganisms. Natural (drinking) waters contained sulfate-reducing bacteria which seemed to multiply in corroded parts. Bacteriological methods for further investigations of these organisms are described.—Copyright 1972, Biological Abstracts, Inc.
W72-10528

FEEDLOT WASTE MANAGEMENT: SOME SOLUTIONS TO THE PROBLEM,
Agricultural Research Service, Lincoln, Neb.
For primary bibliographic entry see Field 05B.
W72-10535

TOTAL ORGANIC CARBON DETERMINATIONS ON SWINE WASTE EFFLUENTS,
North Carolina State Univ., Raleigh.
J. W. D. Robbins, G. J. Kriz, and D. H. Howells.

Paper presented at the 1969 Winter Meeting American Society of Agricultural Engineering, Chicago, Illinois, December 9-12, 1969. Paper No. 69-928. 26 p, 9 fig, 19 ref.

Descriptors: *Farm wastes, *Biochemical oxygen demand, Hogs, Runoff, Lagoons, Confinement pens, Hydrogen ion concentration, Nitrates, Ammonia, Bacteria, Chemical oxygen demand, *Analytical techniques.
Identifiers: *Total Organic Carbon, Fresh manure.

Total organic carbon measurements (using a Beckman 91STOC analyzer) were made on swine waste effluents to establish a rapid and accurate auxiliary method to substitute for and/or complement the BOD test for determining degradable organic contents and/or oxygen demand loadings. The standard BOD test has very limited value for characterizing fresh swine waste and swine waste lagoon effluents although it has considerable applicability for more dilute swine wastes in land drainage. Toxic substances, high solids contents, and/or the requirements for high dilutions in analyses are major factors in this regard. The TOC analysis provides a convenient, rapid, and dependable method for determining the amount and strength of wastes entering streams through land runoff from swine growing operations. While the TOC can be useful in characterizing raw swine waste effluents, its utility for this purpose is presently limited by difficulties common to the standard BOD analysis. If a satisfactory relationship with oxygen demand could be developed, the TOC test would be a better pollution parameter than BOD. Conjunctive use of BOD and TOC parameters can be useful in characterizing swine wastes and wastewaters, particularly when toxic materials and other factors limit the BOD test. The degree of BOD/TOC variability is one indication of wastewater consistency and the possible presence of toxic materials. Also, the BOD/TOC ratio is an indication of the ease of biodegradation and/or the degree of stabilization. (Bundy-Iowa State)

W72-10596

TRACE ELEMENTS IN THE WATER RESOURCES OF CALIFORNIA,
Soil Science and Engineering, Riverside, Calif.
G. R. Bradford.

Hilgardia. Vol 41, No 3, p 45-53. 1971.
Identifiers: *California, *Trace elements, Water resources.

Trace element concentration ranges, means, medians, and number of positive occurrences are listed for 383 water samples from various sources in California. Data are compared to accepted public water supply and irrigation water standards. Municipal and industrial waste water and water extracts from Suisun Bay sediments contained the greatest number of trace elements at concentrations suggesting likely deleterious effects on aquatic life.—Copyright 1972, Biological Abstracts, Inc.
W72-10597

A TECHNIQUE FOR BIOASSAY OF FRESH-WATER, WITH SPECIAL REFERENCE TO ALGAL ECOLOGY,

Freshwater Biological Association, Ambleside (England). Windermere Lab.; and Polish Academy of Science, Krakow. Lab. of Water Biology.
For primary bibliographic entry see Field 05C.
W72-10619

FATTY ACID-CLAY MINERAL ASSOCIATION IN ARTIFICIAL AND NATURAL SEA WATER SOLUTIONS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.

P. A. Meyers, and J. G. Quinn.
Geochimica et Cosmochimica Acta, Vol 35, No 2, p 628-632, February 1971. 1 fig, 1 tab, 5 ref. NSF Grant GH-99.

Descriptors: *Sediments, *Clay minerals, *Montmorillonite, *Sea water, *Organic acids, Investigations, Analytical techniques, Chromatography, Clays.
Identifiers: *Fatty acids.

Many kinds of organic compounds are found in marine sediments. The occurrence of some of these compounds probably has resulted from the association of organic matter in sea water with settling mineral particles. An analytical method using gas liquid chromatography was developed which provides a measure of the amount of fatty acid that can be associated with montmorillonite clay. Analysis of these acids associated with clay isolated from synthetic and natural sea water systems shows a direct relationship between the amount of acid removed from solution and its initial concentration. (Woodard-USGS)
W72-10638

INFRARED SPECTRA OF HUMIC ACIDS AND RELATED SUBSTANCES,
Illinois Univ., Urbana. Dept. of Agronomy.
F. J. Stevenson, and K. M. Goh.
Geochimica et Cosmochimica Acta, Vol 35, No 2, p 471-483, February 1971. 7 fig, 1 tab, 28 ref.

Descriptors: *Soil water, *Decomposing organic matter, *Humic acids, *Chemical analysis, Spectrophotometry, Analytical techniques, Laboratory tests, Fulvic acids, Chemical reactions, Environmental effects, Soils.
Identifiers: Infrared spectra, Humification process.

Humic acid and related substances are widely distributed in terrestrial soils, natural waters, marine and lake sediments, peat bogs, shales, and brown coals. They are important in the transportation and enrichment of mineral substances in sediments and sedimentary rocks. Humic and fulvic acids from several sources were separated into three spectral types depending upon their infrared ab-

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification of Pollutants

sorption characteristics. Those belonging to Type I showed equally strong bands at 1720 and 1600 cm, with no discernible absorption being evident at 1640 cm. A distinguishing characteristic of the preparations giving spectra of Type II was a very strong 1720 cm band, a shoulder at 1650 cm, and the absence of a 1600 cm band. The preparations of Type III showed pronounced bands indicative of proteins and carbohydrates. Observed spectral changes in the 1700-1600 cm region indicated that the humification process consisted, in part, of a loss of COOH groups and a change in the environment of C=O from the free or weakly H-bonded state to strongly chelated forms. (Woodard-USGS) W72-10640

GEOCHEMISTRY AND ORIGIN OF FORMATION WATERS IN THE WESTERN CANADA SEDIMENTARY BASIN—III. FACTORS CONTROLLING CHEMICAL COMPOSITION,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 02F.
W72-10642

THE USE OF FISH MOVEMENT PATTERNS TO MONITOR ZINC IN WATER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology; and Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
For primary bibliographic entry see Field 05B.
W72-10681

TECHNIQUES FOR THE VIROLOGICAL EXAMINATION OF WATERS AND LIQUIDS,
S. Moro.
G Battierol Virol Immunol Ann Osp Maria Vittoria Torino. Vol. 63 No. 9/10 p 467-484. 1970.
Identifiers: Liquids, Virology, *Water analysis, Analytical techniques, *Viruses.

The techniques available for isolation and identification of water-borne viruses are reviewed. The viruses previously observed by investigators in water samples are listed according to type and to the technique used for identification.—Copyright 1972, Biological Abstracts, Inc.
W72-10682

CHROMATE POLLUTION OF WATER - DETECTION, EFFECTS, AND PREVENTION: A BIBLIOGRAPHY,
Oak Ridge National Lab., Tenn.

Available from NTIS, as ORNL TM 3450, \$3.00 paper copy; \$0.95 microfiche. Report No. ORNL-TM-3450, Oct. 1971, R. Stemple compiler, 18 p.

Descriptors: *Bibliographies, *Water pollution, *Water pollution sources, *Water quality, *Industrial wastes, Metals, Documentation, Toxicity, Water pollution effects, Public health, Water purification, Toxins, Economics, Reclaimed water.
Identifiers: Chromates.

Although the chromates are less toxic to animal life than other metallic salts in solution, they add to the total pollution of the world's rivers and streams. The value of the recovery of the chromates from industrial wastes was realized years ago, and resulted in the discovery and utilization of new and more efficient methods for detection and recovery, thus lessening water pollution from this source. This bibliography brings together most of the literature written on the subject from 1953 through the first few months of 1971. (Houser-ORNL)
W72-10684

PHENOL POLLUTION OF WATER: A BIBLIOGRAPHY.
Oak Ridge National Lab., Tenn.

Available from NTIS, as ORNL-TM-3431, \$3.00 paper copy; \$0.95 microfiche. Rept. No. ORNL-TM-3431, Oct. 1971, R. M. Stemple, Compiler 13 p.

Descriptors: *Bibliographies, *Phenols, *Water pollution, *Water pollution sources, *Water pollution effects, Public health, Industrial wastes, Organic compounds, Chemicals, Aromatic compounds, Water purification.

The phenols which pollute water do not occur naturally. They are the results of industrial processes, so they are easier to control and remove. They impart a distinctive unpleasant odor and taste to water, and detection of them is less complicated than other pollutants. This bibliography brings together the literature on phenol pollution, detection, control, and effects on aquatic life over the period 1954 to date. The arrangement is alphabetically by author. (Houser-ORNL)
W72-10685

SENSITIVITY PROBLEMS IN BIOLOGICAL AND ENVIRONMENTAL COUNTING,
California Univ., Livermore. Lawrence Radiation Lab.

G. A. Armantrout, A. E. Bradley, and P. L. Phelps. Available from NTIS as UCRL-73505 \$3.00 in paper copy; \$0.95 microfiche. Report No. UCRL-73505, October 1971, 25 p, 15 ref.

Descriptors: *Gamma rays, *Monitoring, *Environment, Spectrometers, Instrumentation, Technology, Background radiation.

Resolution of Ge (Li) gamma-radiation detectors about 1 cm thick is generally better for planar than for coaxial geometry at detector volume less than 40 cubic cm, and is better in the low-energy region of the gamma radiation spectrum at larger volume. It is unlikely that single planar detectors of greater than 40 cubic cm will be available in the near future; however in this event the planar geometry for 2 cm thick detectors would be the more favorable for all applications. (Bopp-ORNL)
W72-10688

INDEXED BIBLIOGRAPHY ON ENVIRONMENTAL MONITORING FOR RADIOACTIVITY,
Oak Ridge National Lab., Tenn.

For primary bibliographic entry see Field 05B.
W72-10689

SOME IMPORTANT INORGANIC NITROGEN AND PHOSPHORUS SPECIES IN GEORGIA SALT MARSH,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
For primary bibliographic entry see Field 02K.
W72-10706

CHEMICAL CHARACTERIZATION OF DISSOLVED ORGANIC MATTER AND ITS INFLUENCE ON THE CHEMISTRY OF RIVER WATER,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
For primary bibliographic entry see Field 02K.
W72-10707

A REPORT ON WATER QUALITY SURVEILLANCE DURING 1970 ON THE CHICAGO AND CALUMET RIVER SYSTEMS IN THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO.
Illinois State Environmental Protection Agency, Springfield.

1971. 53 P, 17 FIG, 12 TAB.

Descriptors: *Channels, *Inland waterways, *Illinois, *Water quality, *Water quality standards, Turbidity, Nitrates, Hardness, Chemical oxygen

demand, Coliforms, Alkalinity, Chlorides, Sulfates.
Identifiers: *Chicago River, *Waterways, Calumet River, Metropolitan Sanitary District of Greater Chicago.

During 1970, a total of 370 samples were collected from 28 established sampling stations on the Chicago River and Calumet River Systems in the Metropolitan Sanitary District (MSD) of Greater Chicago. All water samples were analysed for sixteen routine water quality parameters. In addition, about 50% of these samples were analysed for 14 heavy metals and toxic substances. Special surveys were conducted (on the MSD waterways) to determine the condition of the waterways based on the examination of the benthic deposits and the benthic organisms present. These special surveys included a dredge survey and monitoring of the waterways using artificial substrate samplers. Direct by-passing of untreated combined storm flows from combined sewers, pollution by direct discharges of industrial wastes, oil spills from industries located along the waterways, discharge of effluent from smaller treatment facilities into tributary streams, oil spills or bilge pumpouts from barges or commercial vessels, and sanitary discharges from commercial and pleasurecraft all contribute to the pollution of the waterways. Although data indicates some minor improvement in the conditions found in the waterways, they are still considered to be polluted. All data obtained during this program was evaluated according to General and Specific Criteria in Rules 1:03 and 1:04 'Rules and Regulations,' SWB-15, which prescribe State and Federal Water Quality Standards for these waterways. (Poertner)
W72-10848

LAKE MICHIGAN 1970 SHORE WATER SURVEY-REPORT MADE TO THE GOVERNOR RICHARD B. OGILVIE AND THE 77TH GENERAL ASSEMBLY.

Illinois State Environmental Protection Agency, Springfield.

1971. 35 P, 14 FIG.

Descriptors: *Illinois, *Water pollution, *Lake Michigan, *Lake shores, *Water quality, Shores, Shallow water, Thermal pollution, Water pollution control, Chemical analysis, Water quality control, Biological properties, Sewage districts, Sewage treatment.

An analysis is reported of the quality of Lake Michigan shore water adjacent to Illinois, conducted during 1970. Included in the report are results of the 1970 sampling of Lake Michigan beach water, a comparison of the 1970 findings with those for 1968 and 1969, a summary of measures being taken to control the discharge of pollution wastes materials into Lake Michigan, regulatory measures that have been taken to improve, control or eliminate sources of pollution, and facilities planned or scheduled to further compliance with state water quality criteria for Lake Michigan. The sampling procedure consisted of taking a weekly grab-sample. Collectors waded into approximately 2 1/2 feet deep water and dipped samples just below the surface. The cyanide, phenol and ammonia samples were treated with fixatives to retard any biological alteration of their composition. Plankton samples were preserved with formaldehyde. The samples for bacterial analysis were collected in sterilized bottles and placed on ice. All samples were delivered to the laboratory within 6 hours after collection. Results were reported under the categories of bacteria, fecal coliform, ammonia nitrates, total soluble phosphates, synthetic detergents, temperature, pH and cyanides, phenol-like substances, and physical observations. The results of the analysis indicated contamination by sewage substantially lower in 1970 than in previous two years. The results of other chemical analysis have either remained roughly the same or become slightly worse over the past 3 years. (Poertner)
W72-10849

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Identification of Pollutants—Group 5A

LAKE MICHIGAN OPEN WATER AND LAKE BED SURVEY 1970.

Illinois State Environmental Protection Agency, Springfield.

1971. 87 p, 24 FIG, 49 TAB.

Descriptors: *Illinois, *Lake Michigan, *Water quality, *Lake beds, *Water pollution effects, *Bottom sampling, *Dredging, *Water sampling, Ecology, Water pollution, Water pollution sources, Water quality standards, Regulations.

Identifiers: Open water, Metropolitan Sanitary District of Greater Chicago.

These surveys were to evaluate the ecology and the quality of the open water of Lake Michigan. Although dramatic improvements over short periods of time are improbable in such large bodies of water such as Lake Michigan, data from 1968-70 suggests slight improvement in the quality of Lake Michigan open water. Lake bed sampling during 1970 indicated that slightly more than half of the stations sampled were "ecologically degraded". Open water samples were collected from municipal water filtration plants. Peterson and Ponar dredges were used to help evaluate any change in the bottom life of Lake Michigan. Results of biological, chemical, and bacteriological analysis were compared to the Water Quality Standards, Rules and Regulations SWB-7. In open waters only the Total Phosphate standard was exceeded. The results showed water quality to improve as it became removed from near shore influences. Results from the lake bed tests showed those with organically enriched muck bottoms to be of poorer quality than the typical sand, clay, rock bottoms. Regulations pertaining to dumping, watercraft discharge, pesticides and filter backwash were initiated with more to follow. These regulations are backed up by the Environmental Protection Act of 1970 and a \$750,000,000 bond issue to help implement it. (Poertner) W72-10870

A SYMPOSIUM ON THE BIOLOGICAL SIGNIFICANCE OF ESTUARIES.

Sport Fishing Inst., Washington, D.C.

For primary bibliographic entry see Field 05C.

W72-10870

A QUICK BIOCHEMICAL OXYGEN DEMAND TEST.

California Univ., Davis.

Copy available from GPO Sup Doc, \$0.60; microfiche from NTIS as PB-210 753, \$0.95. Environmental Protection Agency Water Pollution Control Research Series, June 1971. 48 p, 10 fig, 2 tab, 31 ref. EPA Program 16050 EMF 06/71.

Descriptors: *Biochemical oxygen demand, *Chemical oxygen demand, Bacteria, *Waste water treatment, Biodegradation, Sewage, Municipal wastes, Industrial wastes, Sludge treatment, Biomass, Analytical techniques, Growth rate, Carbon, Protozoa, Microbiology, Predation, Activated sludge, Oxidation, Organic matter. Identifiers: *Total oxygen demand, Winery wastes, Pomace stillage, Enrichment, Sorbitol, Glucose, Biochemical oxidation, Metabolites, Catabolites, Biochemical interference.

A satisfactory, short term biological oxygen demand test suitable for operational control of waste treatment processes was developed. The Total Biological Oxygen Demand (T sub b OD) test, a mass culture technique which utilizes the change in chemical oxygen demand as resulting from bacterial action, was chosen as the basic system. Because the T sub b OD test was developed for and is conceptually limited to soluble wastewaters, considerable modification of the basic test was necessary. Results show that the modified T sub b OD test can be utilized for the determination of the oxygen demand of nonsoluble wastewaters. Values were not affected by dilution as long as the initial (time equals O) wastewater COD value was

greater than 100 mg/l. Additionally, cell concentration does not affect T sub b OD values obtained. Because the test was developed from consideration of the stoichiometry of conversion of organic materials to cells and oxidized end products, values obtained can be related to ultimate or theoretical biochemical oxygen demand values. Of greater utility is the development of COD vs T sub b OD correlations for a specific wastewater, however. (Mackan-Battelle) W72-10871

PROCEEDINGS OF FIRST MEETING ON ENVIRONMENTAL POLLUTION, 15-16 APRIL 1970, SPONSORED BY AMERICAN ORDNANCE ASSOCIATION.

Edgewood Arsenal, Md.

For primary bibliographic entry see Field 05D.

W72-10874

GREAT LAKES ALGAE MONITORING PROGRAM, 1969.

Michigan Water Resources Commission, Lansing, Dept. of Natural Resources.

Report, February 1970. 16 p, 7 fig, 5 tab, 2 ref.

Descriptors: *Algae, *Great Lakes, *Monitoring, *Bioindicators, Thermal pollution, Microscopy, Diatoms, Nutrients, Phytoplankton, Water quality, Michigan, Surface waters, Coasts, Sampling, Biological communities, Lake Michigan, Lake Erie, Lake Huron, Lake Superior, Water temperature, Hydrogen ion concentration, Hardness, Alkalinity, Conductivity, Suspended solids, Nitrates, Nitrites, Nitrogen, Phosphorus, Chloride, Cyanophyta, Currents (Water), Chlorophyta, Scedesmus, *Eutrophication, Water analysis.

Identifiers: Sample preservation, Formalin, Counting, Cyclotella, Oscillatoria, Aphanothecae, Anabaena, Aphanizomenon, Navicula, Glenodinium, Microspora, Syneдра, Dinobryon, Odogonium, Fragilaria, Diatom, Melosira, Tabellaria, Actinastrum, Phytoconis, Cymbella, Stephanodiscus, Ankistrodesmus, Trachelomonas, Saginaw Bay, Organic nitrogen.

Water samples containing algae were collected during 1969 from 49 stations in the Great Lakes to attempt to correlate the algal species with trophic conditions in each lake. Each sample was preserved with formalin and sent to the Lansing laboratory of the Water Resources Commission for microscopic sorting and counting. Water temperature, suspended solids, nitrate-N, ammonia-N, organic N, phosphates, chlorine, sulfates, pH, hardness, carbonates, alkalinity, and conductivity were also determined at the sampling sites. In general, the algal composition of Lake Superior, Lake Michigan, and Lake Huron (with the exception of Saginaw Bay) show low average algae counts with genera characteristic of oligotrophic clean water conditions. Lake Superior and Lake Huron both support a centric diatom population with the most common genus being Cyclotella. In Lake Michigan algal samples, pennate diatoms predominated with Syneдра being the most common genus. Blue-green algae were observed in the southern Lake Michigan samples which may indicate high nutrient levels. Lake Erie and Saginaw Bay, on the other hand, have high algal populations with genera associated with eutrophic conditions.

It is concluded that algae of certain genera, along with other biological organisms, are indicators of water quality and are useful in determining the quality of Michigan's inshore waters. (Mortland-Battelle) W72-10875

EFFECTS OF DIELDRIN IN SEAWATER ON THE DEVELOPMENT OF TWO SPECIES OF CRAB LARVAE, LEPTODIUS FLORIDANUS AND PANOPÆUS HERBSTII.

Duke Univ., Durham, N.C. Dept. of Zoology.

For primary bibliographic entry see Field 05C.

W72-10877

SELECTIVE COMPLEXATION OF IMPURITIES IN THE ELECTRON CAPTURE GAS CHROMATOGRAPHIC DETERMINATION OF SOME CHLORINATED POLYCYCLODIENE PESTICIDE METABOLITES AND DERIVATIVES,

Duke Univ., Beaufort, N.C. Marine Biology Lab.

J. McKinney, L. Fishbein, and L. Barling.

Bulletin of Environmental Contamination and Toxicology, Vol 7, No 1, p 2-8, January 1972. 2 fig, 2 tab, 21 ref.

Descriptors: *Gas chromatography, *Chlorinated hydrocarbon pesticides, Urine, Separation techniques, Centrifugation, Dieldrin, Aldrin, Polychlorinated biphenyls, Pollutant identification.

Identifiers: Electron capture gas chromatography, Biological samples, *Chlorinated polycyclocladene pesticides, *Metabolites, *Hydroxylated metabolites, Trimethylsilyl, TMS, Rare earth metals, *Hexachlorophene, *Chlorobenzene, Europium nitrate, Sample preparation, Detection limits.

An electron capture gas chromatographic technique is described for rapid characterization of low levels of metabolites of chlorinated polycyclocladene pesticides. Europium nitrate was used as a selective complexing agent in determining the metabolites, which are normally masked by procedural impurities. Typical spiking, extraction, and silylation procedures were followed using rat urine as a medium. The results indicated that rare earth metals such as europium may play an important role in the detection of oxygenated metabolites of a variety of biologically important compounds. The method allowed determination of metabolites to concentrations as low as 1 ppm. The desirability of such a convenient and rapid method for low-level determination of chlorinated phenolic systems is emphasized, since such systems are of increasing importance as possible metabolites and degradation products of diverse environmental agents, including hexachlorophene and related systems, chlorobenzenes, and polychlorinated biphenyls. (Mortland-Battelle) W72-10878

GLC SEPARATION OF HEPTACHLOR EPOXIDE OXYCHLORDANE, ALPHA- AND GAMMA-CHLORDANE,

Simon Fraser Univ., Burnaby (British Columbia).

Dept. of Biological Sciences.

D. W. Conder, P. C. Oloffs, and Y. S. Szeto.

Bulletin of Environmental Contamination and Toxicology, Vol. 7, No. 1, p 33-35, January 1972. 1 fig, 1 tab.

Descriptors: *Gas chromatography, *Pesticide residues, *Organic pesticides, Aldrin, Heptachlor, DDD, DDE, DDT, Dieldrin, Pollutant identification, *Chlorinated hydrocarbon pesticides, Separation techniques.

Identifiers: *Gas liquid chromatography, *Chlordane, Oxychlordane, Heptachlor epoxide, OV 17, OV 210, Lindane, p,p'DDE, p,p'DDD, p,p'-DDT, Alpha chlordane, Gamma chlordane, Sample preparation, Chromatograms, Metabolites.

A gas liquid chromatographic method is described for characterizing organochlorine pesticide residues. A column containing 1.5 percent OV 17 plus 1.95 percent OV 210 is used to separate the compounds alpha-chlordane, gamma-chlordane, oxychlordane, and heptachlor epoxide. The OV 17 and OV 210 are dissolved in 150 ml of ethyl acetate and mixed with 25 g of Chromosorb W 'HP'. The slurry is rotated slowly at 70 C while the solvent evaporates under a stream of nitrogen and is then oven-dried for 12 hours at 150 C. Prior to packing, the column is silanized with 5 percent dimethyl-dichlorosilane in toluene. Packing is added in small increments, settled with a mechanical vibrator, and the column ends are plugged with silanized glass wool. Prior to operation, the column is conditioned for 24 hours at 250 C and 100 ml/min nitrogen flow. Retention times, relative to aldrin, under the described conditions are given for lim-

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification of Pollutants

dane, heptachlor, aldrin, oxychlordane, heptachlor epoxide, gamma-chlordane, alpha-chlordane, p,p'DDE, dieldrin, p,p'DDD, and p,p'DDT. (Mortland-Battelle) W72-10880

RAPID METHOD FOR IDENTIFYING ALDRIN IN THE PRESENCE OF SULFUR BY ELECTRON CAPTURE GAS CHROMATOGRAPHY, Northeast Louisiana Univ., Monroe.

J. F. Lester, and J. W. Smiley.

Bulletin of Environmental Contamination and Toxicology, Vol. 7, No. 1, p 43-44, January 1972. 2 fig, 5 ref.

Descriptors: *Gas chromatography, *Aldrin, Analytical techniques, *Sulfur, *Bottom sediments, Pollutant identification, Separation techniques, Chlorinated hydrocarbon pesticides, Water analysis.

Identifiers: Electron capture gas chromatography, Hexane, OV 17, Sample preparation, Chemical interference, Retention time, Chromatograms.

The presence of elemental sulfur in hexane extracts of bottom sediments and water produces a response on electron capture GLC that is similar in retention time to the response of aldrin. However, separation of aldrin from interfering sulfur is readily accomplished by GLC on the polar liquid phase OV-17. A solution coating technique was used to prepare a glass column packed with 3 percent OV-17 on Chromosorb W AWDMCS HP. The column oven was operated at 180°C and the EC detector at 250°C. The carrier gas flow was 90 ml per minute. Bottom sediments were extracted using standard techniques. Aldrin and elemental sulfur are not resolved on the non-polar SE-30 liquid phase. However, good resolution is obtained utilizing the polar OV-17 liquid phase with sulfur having a retention time of 2.09 relative to aldrin. (Mortland-Battelle) W72-10881

PCB AND P,P'-DDE IN EGGS OF CORMORANTS, GULLS, AND DUCKS FROM THE BAY OF FUNDY, CANADA,

Fisheries Research Board of Canada, St. Andrews (New Brunswick), Biological Station.

V. Zitko, and P. M. K. Choi.

Bulletin of Environmental Contamination and Toxicology, Vol. 7, No. 1, p 63-64, January 1972. 1 tab, 6 ref.

Descriptors: *Polychlorinated biphenyls, *Bird eggs, *Food chains, *DDE, Birds, *Black duck, *Gulls, Path of pollutants, Separation techniques, Gas chromatography, Aroclors, Dieldrin, Heptachlor, Feeding habits, Chlorinated hydrocarbon pesticides, *Canada.

Identifiers: *Cormorants, Cleanup, Biological samples, Herring gulls, Aroclor 1254, p,p'DDE, Hexachlorobenzene, Heptachlor epoxide, Aroclor 1260, Bay of Fundy.

Relatively high levels of PCB and p,p'-DDE were found in cormorant, gull, and black duck eggs collected in eastern Canada in May 1971. Samples included three to six eggs taken from several nests and homogenized. Two extracts were prepared from each sample and analyzed in duplicate using gas chromatography. PCB was quantified using the heights of five of the six major Aroclor 1254 peaks. The results indicated that PCB levels in cormorant eggs from the Bay of Fundy are higher than those from areas investigated in other reported studies. PCB levels in gull and duck eggs were lower, which may reflect different feeding habits. (Mortland-Battelle) W72-10882

RECENT DEVELOPMENTS IN THE MEASUREMENT OF THE RESPONSE OF PLANKTON AND PERIPHYTON TO CHANGES IN THEIR ENVIRONMENT.

National Environmental Research Center, Cincinnati, Ohio. Analytical Quality Control Lab.

C. I. Weber.

Paper presented at the Symposium on Bioassay Techniques in Environmental Chemistry 162nd National Meeting, Washington, D.C., September 15, 1972. 29 p, 3 fig, 7 tab, 74 ref.

Descriptors: *Analytical techniques, Chemical analysis, Water analysis, Evaluation, Water quality control, *Bioassay, *Biomass, Chlorophyll, Nitrogen fixation, *Periphyton, *Phytoplankton, Biological communities, Dominant organisms, Reduction (Chemical), Trophic levels, Protozoa, Algae, Bacteria, Diatoms, Oceans, Activated sludge, Soil bacteria, Photosynthesis, Fluorometry, Absorption, Cyanophyta, Chlorophyta, Yeasts.

Identifiers: *Adenosine triphosphate, *Autotrophic index, Macroinvertebrates, Acetylene, Ethylene, Nitrogen radioisotopes, N-15, Luciferin, Luciferase, Chlorophyll a, Optical density, Acetylene reduction, Schizothrix calcicola, Closterium moniliforme, Melosira varians, Navicula tripunctata, Gomphonema parvulum, Bacillari paradoxa, Sphaerotilus natans, Epilimnon, Amphidinium carteri, Chlorella vulgaris, Cyclotella nana, Ditylum brightwellii.

Water quality is reflected in bioassay analysis based upon biomass, population density, and species composition and diversity of aquatic organisms, e.g. plankton, periphyton, macroinvertebrates, fish. Of the more recently developed methods of determining plankton and periphyton biomass and condition, special interest has been focused on chlorophyll a, ATP, and nitrogen fixation as indexes of productivity, respiration, and success in the environment. The primary photosynthetic pigment, chlorophyll a, has been used in development of an "autotrophic index" relationship which has proven valuable in determining the dominance and trophic levels within the plankton and periphyton communities of waterways. Adenosine triphosphate (ATP) offers considerable promise as an index of total viable plankton biomass and also as an index of toxic substances and their effects upon the aquatic system. Since nitrogen is a major cell component, analysis of nitrogen fixation, as indicated by acetylene to ethylene reduction, has lent itself to rapid, accurate evaluations of nitrogen budgets of aquatic organisms and plankton population dynamics. Organisms and specific methodology are included in the discussion of these parameters of analysis as well as data collected to substantiate their value as analytical techniques. (Mackan-Battelle) W72-10883

ISOLATION OF LEPTOSPIRA ANDAMANA FROM SURFACE WATER, Illinois Univ., Urbana. Coll. of Veterinary Medicine.

D. N. Tripathy, L. B. Evans, and L. E. Hanson. Am J Vet Res. Vol 32, No 9: p 1463-1464. 1971. Illus.

Identifiers: *Illinois, Isolation, *Leptospira andamana, Surface water, *Pollutant identification.

Leptospiral strain DS 14 isolated from surface water in Illinois was serologically indistinguishable from L. andamana. (This appears to be the first reported isolation of this serotype from the USA.) Copyright 1972, Biological Abstracts, Inc. W72-10893

COASTAL ZONE BASELINES AND MONITORING FOR POLLUTION AND ENVIRONMENTAL QUALITY.

National Academy of Sciences-National Research Council, Washington, D.C.

Available from NTIS, Springfield, Va. 22151 as PB-207 448 Price \$3.00 Paper copy; \$0.95 microfiche. April 1971. 23 p, 2 append.

Descriptors: *Water pollution sources, *Oceans, *Data collections, *Monitoring, *Project planning, Network design, Water circulation, Mixing, Water analysis, Water properties, Chemical analysis,

Water temperature, Biological properties, Air pollution, Planning, Coasts, Ecology.

At the request of the Coast Guard, an ad hoc panel of the Committee on Oceanography, National Academy of Sciences, prepared a guide for developing the Coast Guard's pollution monitoring and baseline determination program. Sections include circulation and mixing, water samples, air samples, biological samples, and recommendations. The panel recommended that each Coast Guard district develop the necessary observations for baseline monitoring for pollution and environmental quality. Ultimately, a line of stations for observations should extend seaward from each major port to estuary of the coastal zone of the United States. Some of the observations recommended should be made monthly; others, quarterly. At certain fixed locations, more continuous observations (currents for example) were suggested. (Woodard-USGS) W72-10901

ANALYSIS OF THE MAJOR CATIONIC CONSTITUENTS OF THE 1964 TO 1969 SNOW ACCUMULATIONS AT DYE SITES 2 AND 3, GREENLAND, Cold Regions Research and Engineering Lab., Hanover, N. H.

For primary bibliographic entry see Field 02K.

W72-10910

RADIATION MEASUREMENT, Atmospheric Environment Service, Ottawa (Ontario).

J. R. Latimer.

International Field Year for the Great Lakes, Technical Manual Series, No 2, (1972). 53 p, 27 fig, 7 tab, 12 ref, 5 append.

Descriptors: *Lake Ontario, Hydrologic aspects, *Hydrologic data, Water pollution, Water pollution sources, *Radioactivity, Measurement, *Instrumentation.

This manual provides supplementary information and advice to assist participating groups to perform the necessary radiation observations during the International Field Year for the Great Lakes (IFYGL). Such a program implies widely distributed series of observations of solar and terrestrial radiation components for the derivation of representative measures of the radiation balance of Lake Ontario and its basin. The effort during the IFYGL in this connection is directed towards the systematic collection of radiation measurements from such diverse platforms as ships, aircraft, satellites, buoys, and towers, as well as normal land locations. In a guide of restricted scope it is impracticable to discuss descriptive and functional detail of the type normally associated with instructions prepared for use within national networks. Special attention has been paid, however, to avoiding conflict with instruction already provided in national and international guides, as well as the creation of specific instruction for the Field Year. W72-10945

RADIOECOLOGY APPLIED TO THE PROTECTION OF MAN AND HIS ENVIRONMENT (SUMMARY).

European Communities, Luxembourg. Commission.

For primary bibliographic entry see Field 05B.

W72-10946

TRANSFER OF FISSION PRODUCTS FROM ATMOSPHERIC FALLOUT INTO RIVER WATER, Hahn-Meitner-Institut fuer Kernforschung, Berlin (West Germany).

W. Jacobi.

Presented at the Commission of the European Communities International Symposium,

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Sources of Pollution—Group 5B

Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 10 p, 4 fig.

Descriptors: *Fallout, *Aggradation, *Rivers, *Drainage systems, *Freshwater, *Water pollution, *Water pollution sources, *Soil contamination, Surface runoff, Radioisotopes, Public health, Radioactivity, Safety, Food chains, Toxicity, *Transfer, Path of pollutants, *Potable water.
Identifiers: *Ingestion, Concentration.

To estimate the radiation hazard to the population by ingestion of contaminated water from fallout, it is necessary to know the fraction of fallout activity in the drainage area of a river which is transferred into the river water. Some quantitative information about the yield of this transfer process was obtained from evaluation of experimental data, which have been collected during the period of world-wide fallout of fission products from nuclear weapon tests. Data on the yield of fission product transfer from fallout into river water are summarized. (See also W72-10946) (Houser-ORNL)
 W72-10947

CONTAMINATION OF THE SOIL WITH MERCURY, European Atomic Energy Community, Petten (Netherlands). Joint Nuclear Research Center; and European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center; and Reactor Centrum Nederland, Petten.
 For primary bibliographic entry see Field 05B.
 W72-10950

INDICATOR BASED SURVEILLANCE PROGRAM (MARINE) AT A NUCLEAR SITE, Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
 For primary bibliographic entry see Field 05B.
 W72-10958

APPLICATIONS OF RADIOECOLOGY PRINCIPLES TO DESIGN OF AIR POLLUTION EFFECTS RESEARCH PROGRAMS, Environmental Protection Agency, Corvallis, Oreg.
 For primary bibliographic entry see Field 05B.
 W72-10959

UPTAKE INTO MAN'S FOOD CHAIN OF RADON-226 ORIGINATING FROM INDUSTRIAL EFFLUENTS RELEASED INTO RIVERS, (TRANSFERT DANS LA CHAINE ALIMENTAIRE DE L'HOMME, DU RADIUM 226 PROVENANT D'EFFLUENTS INDUSTRIELS DEVERSES DANS DES COURS D'EAU), Centre d'Etude de l'Energie Nucléaire, Mol (Belgium); Institut d'Hygiène et d'Epidémiologie, Bruxelles (Belgium); and Contrôle Radioprotection, Brussels (Belgium).
 For primary bibliographic entry see Field 05B.
 W72-10966

TRACE METALS IN (SURFACE) WATERS, (METALLSPUREN IM WASSER — IHRE HERKUNFT, WIRKUNG UND VERBREITUNG), Stadtwerke Wiesbaden A.G. (West Germany). Laboratori.

K. Haberer, and S. Normann.

Vom Wasser Vol. 38, p 156-182 1971. 9 tab, 85 ref.

Descriptors: *Trace elements, *Potable water, *Toxicity, *Public health, Separation techniques, Metabolism, Water pollution effects, Water pollution control, Water quality control, Water quality standards, Baseline studies, Heavy metals, Path of pollutants, Reviews, Monitoring, On-site investigations, Water works, Data collections.

The increase in pollution and additive toxic action of pollutants require continual surveillance of sur-

face waters which are used for drinking water preparation. To facilitate comparison with published results, compilations are presented of tolerances for 26 different trace elements; and of their effects on the metabolism of microorganisms, fish, and man. Toxic limits are occasionally reached in some rivers. Separation of toxic elements should be researched in order that this capability may be provided at water treatment plants when necessary. (Bopp-ORNL)
 W72-10975

ENVIRONMENTAL MONITORING IN THE VICINITY OF THE LOS ALAMOS SCIENTIFIC LABORATORY, JANUARY THROUGH JUNE, 1971.

Los Alamos Scientific Lab., N. Mex.

Available from NTIS, AS LA-4871, \$3.00 in paper copy, \$0.95 microfiche. Report No. LA-4871 MS, Jan. 1972. 43 p.

Descriptors: *Monitoring, *Measurement, *Water pollution, *Water pollution sources, *Radioactivity, *Air pollution, Fallout, Groundwater, Soil contamination, Sampling, Analytical techniques, Sedimentation, Geology, Evaluation, Climatic data, Plutonium, Tritium, Hydrology.
Identifiers: Concentration, Los Alamos (N. Mex.).

The environmental monitoring program in effect at the University of California Los Alamos Scientific Laboratory during the first half of calendar year 1971 is described. Results of programs designed to monitor radiation levels in the laboratory environs, including the atmosphere, local surface and groundwaters, sediments and soils are presented. These measurements are used to make estimates of the dose commitments due to plutonium and tritium concentrations in air. Appendices describe the boundaries of the laboratory site, the programs associated with various laboratory technical areas, geologic, climatologic and economic characteristics of the Los Alamos area, and laboratory procedures used for the analysis of samples. Figures give the site boundaries, sampling stations, and topographic features. (Houser-ORNL)
 W72-10982

INORGANIC SEPARATION AND ANALYSIS BY HIGH SPEED LIQUID CHROMATOGRAPHY

Ames Lab., Iowa.

J. P. Sickafuse.

Available from NTIS as IS-T-498, \$3.00 in paper copy, \$0.95 microfiche. PhD Thesis, Report No. IS-T-498, November 1971. 133 p, 65 ref.

Descriptors: *Analytical techniques, *Chromatography, *Spectrophotometry, *Metals, Trace elements, Iron, Chromium, Zinc, Cadmium, Time, Separation techniques, Chelation, Oxidation-reduction potential.

A liquid chromatograph is described which permits rapid separation and analysis of metal ions in highly corrosive eluents. A spectrophotometer, with a microvolume-flowthrough cell monitors the eluate continuously. For metal ions without color in the eluate, a buffer plus color-forming reagent is mixed in stream prior to detection. Demonstration analyses performed in about 10 minutes included: 10-100 microg of iron (III) in hydrochloric acid solution, 1-10 microg of chromium (IV) in complex matrices, 1-4 microg of zinc, and 1-10 microg of cadmium. (Bopp-ORNL)
 W72-10985

RADIONUCLIDES IN WATER

Atomic Energy Commission, Oak Ridge, Tenn.

Available from NTIS as TID-3311 (Suppl. 3), \$6.00 in paper copy, \$0.95 microfiche. Report No. TID-3311 (Suppl. 3), April 1972. 592 p.

Descriptors: *Bibliographies, *Radioactive wastes, *Nuclear wastes, Radioactivity effects, Water pollution effects, Radioactivity, Background radiation, Public health, Waste treatment, Waste disposal, Path of pollutants, Food chains.

The 2249 references cited were selected from Nuclear Science Abstracts, Vol. 21 (1967) through issue 4 of Vol. 27 (1972). Corporate author, author, report number, and subject indexes are included. The subheadings under the reactor name give comprehensive coverage of reports on radioactive effluents and their effects. (Bopp-ORNL)
 W72-10988

POND-TROUTS AS CARRIERS OF CLOSTRIDIUM BOTULINUM AND CAUSE OF BOTULISM: 3. DETERMINATION OF CLOSTRIDIUM BOTULINUM TYPE E IN A POND FISH CULTURE WITH PROCESSING PLANT AS WELL AS IN FRESH AND SMOKED TROUTS OF DIFFERENT ORIGIN, Tierärztliche Hochschule, Hanover (West Germany). Institut Tierärztliche Lebensmittelkunde Fleischhygiene.

For primary bibliographic entry see Field 05C.
 W72-10996

EXPERIMENTAL DATA FOR ESTABLISHING THE CONTENT OF ALPHA, ALPHA, BETA-TRICHLOROPROPIONIC ACID AND OF ITS SODIUM SALT IN INLAND WATERS, O. V. Es'Kina.

Tr Sarat Med Inst. Vol 71, No 88, p 7-10. 1970.

Identifiers: Inland waters, Pesticides, *Propionic acid, Rabbits, Rats, Sodium, Water pollution, *Pollutant identification.

The herbicide, alpha, alpha, beta-trichloropropionic acid (I), and its Na salt (II) are derivatives of chlorine-substituted aliphatic acids. The threshold for smelling I and II in water is 0.01 and 1.45 mg/l and for taste 0.01 and 1.15. I at 1 and 5 mg/l and II at 10 and 50 had no effect on the variables of the general sanitary regime of the waters. The LD₅₀ of II in mg/kg for mice is 7000, for rats 4500 and for rabbits 5000. The clinical picture of acute poisoning is dominated by anesthetic symptoms. When II was given orally to mice at a dosage of 1/5 of the LD₅₀ daily for 21 days, there was no indication of cumulation. When II was given intragastrically to rats at 1/5 and 1/20 of the LD₅₀, there was a reduction in the content of serum SH groups, an increase in the relative weight of the liver, kidney and adrenals, and in the ascorbic acid content of the latter.—Copyright 1972, Biological Abstracts, Inc.

W72-11005

MERCURY IN WATERS OF THE UNITED STATES, Geological Survey, Menlo Park, Calif.

For primary bibliographic entry see Field 05B.
 W72-11078

AVAILABILITY AND QUALITY OF GROUND-WATER IN THE ASHLAND QUADRANGLE, JACKSON COUNTY, OREGON, Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 07C.
 W72-11082

5B. Sources of Pollution

BASIC PATTERNS IN THE ACCUMULATION OF IODINE, BROMINE, BORON, STRONTIUM, POTASSIUM, BARIUM AND OTHER TRACE ELEMENTS IN DIFFERENT TYPES OF INDUSTRIAL WATER (OSNOVNYE ZAKONOMERENIYA NAKOPENIYA YODA, BROMA, BORA, STRONTSIYA, K ALIYA, BARIYA I DRUGIKH MIKROELEMENTOV

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources of Pollution

RAZLICHNYKH TIPAKH PROMYSHLEN-
NYKH VOD),
All-Union Scientific Research Inst. of
Hydrogeology and Engineering Geology, Moscow
(USSR).
For primary bibliographic entry see Field 02F.
W72-10444

DDT IN SURFACE WATERS, (IN GERMAN),
Hygiene-Institut, Schwerin (East Germany).
For primary bibliographic entry see Field 05C.
W72-10460

TURBULENT DIFFUSION AND DISPERSION IN
OPEN CHANNEL FLOW,
Geological Survey, Fort Collins, Colo.
For primary bibliographic entry see Field 08B.
W72-10461

REMOTE MEASUREMENT OF POLLUTION.
National Aeronautics and Space Administration,
Washington, D.C.

Available from NTIS, Springfield, Va. 22151.
NASA SP-285 Price - \$3.00 paper copy. Special
Publication NASA SP-285, 1971. 253 p, 10 fig, 17
tab, 363 ref.

Descriptors: *Remote sensing, *Pollutant identification, *Water pollution, *Air pollution, Path of pollutants, Satellites (Artificial), Electromagnetic waves, Solar radiation, Instrumentation, Photometry, Radar.

Panel discussions on gaseous air pollution, water pollution, and particulate air pollution were held during the August 16-20, 1971, meeting of the Working Group on the Remote Measurement of Pollution, National Aeronautics and Space Administration. The reports of the Gaseous Air Pollution Panel and the Water Pollution Panel describe specific pollutants and the current ability to measure them by remote techniques. The report of the Particulate Pollution Panel states that some very important things can be done immediately in this area but the full potential requires additional basic research on the scattering and absorption properties of typical aerosol particles. Many of the trace gases are amenable to remote sensing; some water pollutants can be measured by remote techniques, but their number is limited; and an approach to the remote measurement of specific particulate pollutants requires understanding of their physical, chemical, and radiative properties. Remote sensing can provide essential information in all three categories that cannot be obtained by any other means. (Knapp-USGS)
W72-10468

CONCENTRATION FACTORS IN THE
AQUATIC ENVIRONMENT,
New York Univ., Medical Center, N.Y. Inst. of
Environmental Medicine.
For primary bibliographic entry see Field 05A.
W72-10472

GENERAL NATURE OF SOLUBLE AND
PARTICULATE ORGANICS IN SEWAGE AND
SECONDARY EFFLUENT,
Geological Survey, Washington, D. C. Water
Resources Div.
D. A. Rickert, and J. V. Hunter.
Water Res. Vol 5 No 7 p 421-436. 1971. Illus.
Identifiers: Activated sludge, *Effluents, *Organics, Particulate, *Sewage, Sludge.

The size distribution of collective organic parameters was analyzed for sewage and secondary effluent. One soluble and 3 particulate fractions were physically separated from each system by settlement and high speed centrifugation. In character, particulate solids were highly organic and soluble solids largely inorganic in both systems. COD (chemical oxygen demand)/TOC

(total organic carbon) ratios and carbon oxidation numbers showed that organic carbon in sewage was in a low state of oxidation, while that in effluent was in a relatively high state of oxidation. In both systems the oxidation state of carbon in soluble organics was distinctive from that in the particulate organics. Activated sludge treatment resulted in reduction of organic parameters in the order of COD > TOC > volatile solids. Treatment was considerably more efficient in reducing the concentration of particulate organics than in reducing the concentration of soluble organics.—Copyright 1972, Biological Abstracts, Inc.
W72-10478

A MANUFACTURER'S RESPONSIBILITY FOR
NATURAL RESOURCES,
Australian Paper Manufacturers Ltd., Melbourne
(Australia).
For primary bibliographic entry see Field 05G.
W72-10527

FEEDLOT WASTE MANAGEMENT: SOME
SOLUTIONS TO THE PROBLEM,
Agricultural Research Service, Lincoln, Neb.
N. P. Swanson, and C. B. Gilbertson.
Paper presented at the 1971 annual meeting, American Society of Agricultural Engineers, Washington State University, June 27-30, 1971, Paper No. 71-522. 6 p, 9 ref.

Descriptors: *Farm wastes, *Feed lots, Moisture content, Sampling, Runoff, Settling, Basins, Weirs, Analytical techniques.

Identifiers: Bedloads.

Feedlot waste management has come under increased scrutiny for the related reasons of waste disposal problems and pollution potential. Measurement of these wastes is necessary to determine their chemical and physical content, to determine rates of waste accretion and degradation, and to assess the transport of wastes by runoff. Characterization of feedlot wastes required quantitative measurement of manure accumulations on the feedlot surface, runoff from rainfall and snowmelt, movement into the soil profile, and the air quality surrounding the feedlot. The measurement and sampling of runoff from feedlots must include solid contents and bedloads. Some satisfactory methods of measurement include volumetric measurement, Parshall flume, and weirs; methods found unsatisfactory include the trapezoidal flume and Hs- and H-type measuring flumes. Time-sequential, rotating dipper, proportional samplers are satisfactory for obtaining representative samples of feedlot runoff. Ideally, a runoff hydrograph should be accompanied by a sequence of representative samples of the runoff and bedload, each sample taken over a uniform time interval. (Bundy-Iowa State)
W72-10535

TEMPERATURE PREDICTION IN STRATIFIED
WATER: MATHEMATICAL MODEL-USER'S
MANUAL.
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.

Copy available from GPO Sup Doc, \$1.25; microfiche from NTIS as PB-210 701, \$0.95. Environmental Protection Agency Water Pollution Control Research Series, April 1971. 125 p, 24 fig, 29 ref. EPA Program 16130 DJH 04/71.

Descriptors: *Water temperature, *Thermal stratification, *Mathematical models, Reservoirs, Water quality control, Computer programs, Solar radiation, Convection, Advection.
Identifiers: *Fontana reservoir.

Predictions of the complex annual cycle of temperature changes in a lake or reservoir are necessary if proper water quality control is to be achieved. Many lakes and reservoirs exhibit

horizontal homogeneity and thus a time-dependent, one-dimensional model describing the temperature variation in the vertical direction is adequate. A discretized mathematical model was developed based on the absorption and transmission of solar radiation, convection due to surface cooling and advection due to inflows and outflows. The model contains provision for simultaneous or intermittent withdrawal from multi-level outlets and time of travel for inflows within the reservoir. Predicted and measured temperatures agree well in both the laboratory and field. Field verification consisted of the simulation of the thermal structure of Fontana reservoir during a nine-month period. Criteria for the applicability of the model are given. The mathematical model is a predictive one, since the required data would normally be available before the construction of a reservoir. Emphasis is placed on an explanation of the computer program rather than on the development and testing of the theory. (Eagle-Vanderbilt)
W72-10547

POTENTIAL ENVIRONMENTAL MODIFICATION PRODUCED BY LARGE EVAPORATIVE COOLING TOWERS.
EG and G Inc., Boulder, Colo. Environmental Services Operation.
For primary bibliographic entry see Field 05C.
W72-10548

A PHENOMENOLOGICAL RELATIONSHIP
FOR PREDICTING THE SURFACE AREAS OF
THERMAL PLUMES IN LAKES,
Argonne National Lab., Argonne, Ill. Center for Environmental Studies.
J. G. Asbury, and A. A. Frigo.

Available from the National Technical Information Service as ANL/ES-5, \$3.00 in paper copy, \$0.95 in microfiche. Report ANL/ES-5, April 1971. 20 p, 1 fig, 2 tab, 7 ref.

Descriptors: *Lakes, *Forecasting, Temperature, Flow rates, Powerplants, Outlets, On-site data collections.

Identifiers: *Thermal plumes, Phenomenological relationship, Surface areas.

A phenomenological relationship for surface areas within isotherms has been developed for thermal plumes in large lakes. The approach was taken assuming that the behavior of lake plumes beyond the zone of flow establishment is governed by lake processes for which adequate models do not exist and that a set of lake-plume temperature measurements which can be examined for relationships among the plume variables is available. The data were displayed on log-log paper with fractional excess temperature plotted against surface area discharge flow rate. All the buoyant-plume data fit well to the curve drawn through the data points. The curve represents a phenomenological fit relating fractional excess temperature to the quotient of plume surface area and volumetric discharge flow rate. The fit may not be applicable to other outfall geometry, particularly when the fractional excess temperature is large. The curve represents a useful rule of thumb for predicting surface areas of buoyant thermal plumes. (Upadhyaya-Vanderbilt)
W72-10556

LATERAL SPREADING OF HEATED
DISCHARGE,
Wadco Corp., Richland, Wash.
J. C. Sonnichsen, Jr.
Journal of the Power Division, American Society of Civil Engineers, Vol. 97, No. PO3, Proc. Paper 8245, p 623-630, July 1971, 2 fig, 1 tab, 9 ref.

Descriptors: *Heated water, Diffusion, Dispersion, Effluents, Temperature, Mixing, Rhodamine, *Thermal pollution, Path of pollutants.
Identifiers: *Lateral spreading, Two phase flow.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Sources of Pollution—Group 5B

The effect of density variation on the dispersion of effluent released into a fluid field was examined at the U.S. Atomic Energy Commission facilities, Hanford, Washington, releases were made under load (heated) and no load (non heated) conditions. Data collected on magnetic tape were transposed into stereo pairs which could be analyzed with the use of a stereo viewer. Results obtained from in situ measurements indicate a substantial difference in the effective diffusion coefficient for the heated and non heated conditions. It appears that as the momentum of the ambient fluid increases, the effect of the density differential on the mixing process becomes less significant. An explanation of the difference observed follows from the mutual intrusion of two heterogeneous fluids. (Upadhyaya-Vanderbilt)
W72-10562

HEATED SURFACE JETS IN STEADY CROSS-CURRENT,
Federal Water Pollution Control Administration, Portland, Oreg.; and Wisconsin Univ., Madison. Dept. of Civil Engineering.

R. W. Zeller, J. A. Hoopes, and G. A. Rohlich. Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 97, No. HY9, Proc. Paper 8385, p 1403-1426, September, 1971, 8 fig, 24 ref.

Descriptors: *Cooling water, *Jets, Hydraulics, Mathematical models, Lakes, *Thermal pollution, Thermal powerplants, Temperature, Wind velocity, Outlets, *Wisconsin.

Identifiers: *Jet flow, *Crosscurrent, Jet diffusion, Two dimensional flow, Entrainment coefficient, *Lake Monona (Wis).

Twenty-two field surveys were made of the velocity and temperature patterns from the discharge of the two outfall conduits of a 190 Mw power plant into Lake Monona, Wisconsin. These surveys indicated that, beyond a shallow region close to shore, the warm water spreads as a two-dimensional momentum jet in a surface layer about 1 m thick. A mathematical model, using the integral mass, momentum and energy equations, is developed to describe the jet temperature, velocity, width and curvature; the effects of wind shear are included in the model. Data reduction techniques were programmed to facilitate compilation of extensive field data. The model predicted jet center line velocities within 2 cm per sec and center line jet temperatures within 1 C of the field observations. Entrainment coefficients were one to 10 times greater than for jets in a quiescent fluid. Vertical entrainment was negligible. The surface heat loss from the jets to the atmosphere was negligible relative to the rapid dilution of the heat in the lake. (Upadhyaya-Vanderbilt)
W72-10564

COOLING WATER DENSITY WEDGES IN STREAMS,
Vanderbilt Univ., Nashville, Tenn. Dept. of Sanitary and Water Resources Engineering.
E. M. Polk, B. A. Benedict, and F. Parker. Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 97, No. HY10, Proc. Paper 8446, p 1639-1652, October 1971, 13 fig, 4 tab, 8 ref.

Descriptors: *Density stratification, *Mathematical models, Hydraulics, Powerplants, Temperature, Stratified flow, Stream flow, *Thermal pollution, Cooling water, On-site investigations.

The length of warm water density wedges measured in streams receiving power plant discharges is adequately predicted by equations based on two layer flow theory when proper evaluation of the variables is made. The formation of density wedges in the vicinity of power plant discharges is an important consideration in both the design of cooling water intakes and the possible thermal pollution of the receiving water body. Equations have been developed by other authors which may be

solved for the length of a density wedge given the density of the wedge, the initial depth of the wedge, and the magnitude of the frictional forces involved. Wedge length data obtained from four power plants sites are compared to the prediction of the equations. The predicted wedge length is least sensitive to the initial wedge depth chosen, more sensitive to the magnitude of the frictional forces chosen, and most sensitive to the density chosen. Densities based on plant discharge temperature are always less than that actually measured in the wedge. (Upadhyaya-Vanderbilt)
W72-10566

HEAT DISPERSAL-LAKE TRAWSFYNYDD COOLING STUDIES,
Central Electricity Generating Board (England). Northwestern Region. W. McMillan.

In: Symposium on Freshwater Biology and Electric Power Generation, Part I, Central Electricity Research Laboratories, United Kingdom, April 22, 1971, p 41-79, 14 fig, 4 tab, 20 ref.

Descriptors: *Winds, *Stratification, *Mixing, Mathematical studies, Equations, Cooling water, Powerplants, Meteorological data, Instrumentation, Outlets, Water temperature, Thermal pollution.

Identifiers: *Lake Trawsfynydd, *Cooling studies, Cooling ponds, Surface cooling.

The dependence of cooling to the lake on meteorological conditions and the mixing of the heated power station effluent with lake water and its subsequent effect on the water temperature distribution throughout the lake were investigated. The experiment is described and heat loss formulae are presented for a wide variety of meteorological measurement conditions as well as confirmatory investigations on other water bodies. These formulae, if used under the measurement conditions described, are capable of providing accurate heat loss estimates from a wide range of open water surfaces. Cooling pond behavior under the influence of a warmed discharge is also discussed. Away from outfalls and intakes, water movements are largely wind controlled. Density currents and, where it is present, solar heating, assist in promotion of temporary stratification. In general, prolonged winds below 3 m/sec permit stratification, and winds above 6 m/sec destroy it. (Upadhyaya-Vanderbilt)
W72-10569

THE NITRATE HAZARD IN WELL WATER, WITH SPECIAL REFERENCE TO HOLT COUNTY, NEBRASKA,
Geological Survey, Lincoln, Nebr. R. A. Engberg.

Nebraska Water Survey. Paper 21, University of Nebraska, Conservation and Survey Division, Lincoln, October 1967. 18 p, 6 fig, 15 ref.

Descriptors: *Farm wastes, Feed lots, Nitrates, Wells, Well data, Well regulations, Percolating water, Pumping, Cattle, Water pollution sources, Water pollution.

Identifiers: *Infant feeding.

High nitrate concentrations in drinking water are a potential health hazard and should be of concern to the user. They not only render the water unsafe for use in infant feeding but generally indicate that the supply is contaminated. Reports of high-nitrate water from several wells in northern Holt County prompted the Lincoln, Nebraska, office of the U.S. Geological Survey to look into the problem—to determine its seriousness, define causes, and suggest ways to cope with it. To augment the analytical information already on file, water samples were obtained from 71 wells for determination of the nitrate concentration. Concentrations ranging from 0.1 to 409 ppm (parts per million) were found. In order to predict whether a certain well is likely to yield water containing nitrate derived from a nearby source, the rate the well will be

pumped and the direction of groundwater movement need to be known. The greater the rate of pumping, the greater the area from which the pumped water will be derived. A well inside or very close to a feedlot is likely to yield high-nitrate water whether the rate of pumping is small or large, whereas a well more distant from the feedlot may need to be pumped heavily for the high-nitrate water to be drawn into it. (Bundy-Iowa State)
W72-10591

WATER POLLUTION AND AGRICULTURE,
Kansas State Department of Health, Topeka. Environmental Health Services. M. W. Gray.

(1968), 14 p, 2 tab.

Descriptors: *Farm wastes, Feed lots, Runoff, Kansas, Rainfall, Biochemical oxygen demand, Bacteria, Coliform, Streptococcus, Fishkill, Culture, Lagoons, Irrigation.

Natural runoff pollution is defined as pollution resulting from all silts and organic materials carried by watercourses not originating from municipal, industrial, or agricultural operations. Agricultural pollution is pollution as a result of surface runoff, seepage, percolation and return flow from cultivated land used for producing food and feed crops. Animal feedlot pollution is pollutants originating from animal feeding operations of restricted area where the feed supply is nutritionally balanced for maximum animal weight gain prior to marketing. The public generally thinks first of pollution as originating from some industrial plant with black clouds of smoke pouring from its stacks and equally black foul liquids pouring from subterranean channels. The public probably will not be acquainted with pollution from agriculture except fishermen who have practiced their art in the areas of some of our highly intensified farming-livestock areas. (Bundy-Iowa State)
W72-10592

BUFFALO LAKE PROJECT, RANDALL COUNTY, TEXAS.

Robert S. Kerr Water Research Center, Ada, Okla.

December 1968, 64 p, 7 fig, 10 tab, 36 ref.

Descriptors: *Farm wastes, *Runoff, Rainfall, Bacteria, Coliforms, Streptococcus, Lakes, Recreation, Water sports, *Texas.

Identifiers: *Buffalo Lake (Tex).

Buffalo Lake is a shallow, man-made reservoir of 18,150 acre-feet capacity located on Tierra Blanca Creek, some 50 miles southwest of Amarillo, Texas. During this study the lake was only 13 feet deep at its deepest portion near the dam. At this depth the lake contained 3990 acre-feet of water and had a surface area of approximately 950 acres. The shoreline is characterized by gently sloping sandy beaches readily accessible by automobile. The overall objective of the Buffalo Lake pollution study as sponsored by the Texas Water Quality Board is to determine the cause of the recurring pollution of Buffalo Lake. The objectives include the answers to the following questions: (1) What effect do the various waste sources have on the bacteriological quality. (2) What is the fate of the three indicator groups of bacteria entering the lake. (3) What effect does the extensive water contact recreational use of Buffalo Lake have on the total coliform, fecal coliform and fecal streptococci densities. (4) What are the densities of coliforms in and around the lake before and after rainfall. (5) Does the bottom mud in the lake contain any appreciable densities of the three bacterial indicators. (6) Do any appreciable concentrations of pesticides exist in the lake. (7) What corrective measures should be taken to control the bacterial pollution of Buffalo Lake and its tributaries. It was recommended that the city of Hereford should properly chlorinate its treated sewage effluent on a

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continuous basis to protect the bacteriological quality of Tierra Blanca Creek; and that any portion of Buffalo Lake which becomes contaminated by bacterial density of over 200 fecal coliforms per 100 ml should be posted to water contact recreation. (Bundy-Iowa State)
W72-10604

PRELIMINARY MEASUREMENTS OF MID-SUMMER METABOLISM IN BEDS OF EEL-GRASS, ZOSTERA MARINA,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 05C.
W72-10615

ALGAE OF THE LITORAL OF WEST COAST OF SAKHALIN,
For primary bibliographic entry see Field 05C.
W72-10623

EUTROPHICATION ANALYSIS: A MULTIVARIATE APPROACH,
Environmental Health Center, Ottawa (Ontario).
For primary bibliographic entry see Field 05C.
W72-10627

NITROGEN AND PHOSPHORUS CONTENT OF WATER FROM TILE DRAINS AT TWO LEVELS OF MANAGEMENT AND FERTILIZATION,
Cornell Univ., Ithaca, N.Y. Dept. of Agronomy.
P. J. Zwerman, T. Greweling, S. D. Klausner, and D. J. Lathwell.
Soil Science Society of American Proceedings, Vol. 36, p 134-137, 1972. 1 fig, 7 tab, 10 ref.

Descriptors: *Drainage water, *Fertilization, Water pollution sources, *Leaching, *Nitrogen, *Phosphorus, Tile drains, Agriculture, Nitrates, Ammonia, Phosphates, Agricultural runoff, Soils. Identifiers: Lima-Kendaia soil.

Since excessive nitrogen and phosphorus are a major cause of increased growth of undesirable aquatic vegetation in lakes and streams and excessive nitrates are a public and animal health hazard, a study was made to compare nitrogen and phosphorus losses from the soil through drainage water under two levels of conservation management. The experimental field was made up of approximately 12 hectares of a Lima-Kendaia soil association. High and moderate rates of fertilization were applied. Effluent from the drains was measured and analyzed for inorganic nitrogen and orthophosphate. During two 3-week test periods, nitrate calculated as nitrogen delivered from the tile drains in kilos/ha per week ranged from .225 to 2.75. Ammonium concentrations seemed to be only slightly related to fertilization, ranging consistently between .02 to .03 ppm. Weekly outputs of ammonia nitrogen calculated as nitrogen were less than .00258 kilos/ha. Orthophosphate concentrations calculated as phosphorus ranged from .004 to .01 ppm with a weekly output range of .00016 to .00088 kilos/ha. Nitrogen was applied as ammonium nitrate. Phosphorus was applied at 46% superphosphate. (Jones-Wisconsin)
W72-10628

POSTDEPOSITIONAL MOBILITY OF SOME TRANSITION ELEMENTS, PHOSPHORUS, URANIUM AND THORIUM IN DEEP SEA SEDIMENTS,
Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
For primary bibliographic entry see Field 02J.
W72-10635

THE USE OF A THERMAL LINE SCANNER IN THE REMOTE SENSING OF WATER POLLUTION,
Wisconsin Univ., Madison. Remote Sensing Group; and Wisconsin Univ., Madison. Marine Studies Center.
F. L. Scarpace, and T. Green, III.

Available from the National Technical Information Service as COM-72-10121, \$3.00 in paper copy, \$0.95 in microfiche. Wisconsin University Sea Grant Program Technical Report No 13, 1972. 11 p, 7 fig, 2 ref. Grant No WIS-SG-72-213.

Descriptors: *Remote sensing, *Water pollution sources, *Lake Michigan, *Thermal pollution, *Aerial photography, Instrumentation, Analytical techniques, Aircraft, Surface waters, Rivers, Infrared radiation, Outfall sewers, Nuclear powerplants, Nuclear wastes. Identifiers: Thermal line scanner.

Remote sensing of surface parameters of water bodies was used to study pollution sources on the Fox River in Neenah-Menasha, the Point Beach Powerplant located on Lake Michigan, and a section of the western coastal zone of Lake Michigan. The Neenah-Menasha plant is a municipal sewage treatment plant which handles approximately twenty million gallons of sewage per day for the cities of Neenah and Menasha, Wisconsin. Stagnant water lies at the bend in the river on the near downstream side of the outfalls. Here a proliferation of green algae exists that feed off the treated sewage. The visible portion of this pollutant was recorded on 35 mm color and 35 mm color IR film. The Point Beach Nuclear Powerplant is located on Lake Michigan approximately 5 miles north of Two Rivers, Wisconsin. The imagery from the thermal line scanner shows the thermal structure of the plume. The temperature at the intake was 16.4 deg C; the temperature at the outfall was 25.7 deg C. Thermal imagery of the powerplant on the western coastal zone of Lake Michigan shows relatively sharp demarcation between the cold water near shore and warmer offshore water. (Woodard-USGS)
W72-10644

RECONNAISSANCE OF THE OXYGEN BALANCE AND THE VARIATION OF SELECTED NUTRIENTS IN THE SAN ANTONIO RIVER DURING LOW FLOW,
Geological Survey, Austin, Tex.
J. Rawson.

Texas Water Development Board Report 142, February 1972. 11 p, 8 fig, 2 tab, 1 ref.

Descriptors: *Water quality, *Dissolved oxygen, *Nutrients, *Rivers, *Texas, Low flow, Data collections, Streamflow, Flow rates, Sampling, Chemical analysis, Sewage effluents, Biochemical oxygen demand, Nitrogen, Phosphates, Water pollution sources, Path of pollutants. Identifiers: San Antonio River (Tex).

A water-quality reconnaissance of the San Antonio River in Texas was made to describe the progress of waste assimilation, to delineate the critical reach of the river (the reach in which the minimum dissolved-oxygen concentration occurs), and to determine the concentrations of selected nutrients in the river during the low-flow period June 16-19, 1969. Water-quality and discharge data were obtained at seven sites in the 136.5-mile reach of the river between Farm Road 1518 near Elendorf and Goliad. The mean discharge ranged from 128 cfs near Elendorf consisted of treated sewage effluent. The quantity of treated effluent released into the San Antonio River about 18 miles upstream from the site near Elendorf ranged from 46 to 138 cfs and averaged about 100 cfs. The time-weighted concentration of dissolved oxygen and the dissolved-oxygen deficit, during the period from 1200 hours on June 17 to 1400 hours on June 19, show that the critical part of the reach extended from site 1 (mile 203.0) to site 2 (mile 175.5). The dissolved-oxygen content of water in this 27.5-mile reach averaged about 5.0 mg/liter

and the dissolved-oxygen deficit averaged about 3.0 mg/liter. (Woodard-USGS)
W72-10651

SURVEY OF TOXAPHENE LEVELS IN GEORGIA ESTUARIES,
Georgia Univ., Sapelo Island. Marine Inst.
R. J. Reimold, and C. J. Durant.
Available from the Marine Resource Center, Savannah, Ga. Technical Report Series No. 72-2, Feb. 1972, 51 p, 2 fig, 25 tab, 10 ref.

Descriptors: *Surveys, *Data collections, *Hydrologic data, *Measurement, *Assay, Analytical techniques, Evaluation, Water pollution, Pollutant identification, Sampling, Bioassay, Environment, Toxicity, Poisons, Algal toxins, Fish toxins, Sediments, Salt marshes, Ecology, Pesticides, Estuaries, Intertidal areas, Estuarine fisheries.

Data collected and processed from 1 August 1970 to 31 July 1971 are included. An effort is made to cover each portion of the research with explanations of methodology and results. This procedure deviates from the normal introduction, methods, results and discussion to provide the reader with a coherent summary of the research findings. The sections are subdivided in the following broad categories: (1) environmental toxaphene residue surveys (except sediment); (2) sediment analysis; (3) bioassays; (4) trawl data; and (5) summary of findings related to the problems of toxaphene contamination in the salt marsh. (Houser-ORNL)
W72-10678

THE USE OF FISH MOVEMENT PATTERNS TO MONITOR ZINC IN WATER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology; and Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
W. T. Waller, and J. Cairns, Jr.
Water Research, Vol. 6, No. 3, March 1972, p 257-269. 5 tab, 18 ref.

Descriptors: *Monitoring, *Environment, *Aquatic environment, *Toxicity, *Zinc, *Fish, Fish behavior, Water pollution, Fish migration, Light, Path of pollutants. Identifiers: Fish movements, Abnormal movement patterns.

Fish movement patterns monitored by light beam interruptions give a reliable index of premortal zinc toxicity under the conditions tested. The relationship between abnormal movement patterns and other toxicants has not been established. However, because the analysis used to distinguish between normal and abnormal movement patterns is based on changes in variance recorded for light beam interruptions, regardless of the direction of change, the system should detect premortal signs of toxicity for other pollutants. The same statistical procedure has been used to analyze breathing movements of fish confined in plastic cylinders. (Houser-ORNL)
W72-10681

DISPOSAL OF LIQUID WASTES INTO COASTAL WATERS,
Battelle Memorial Inst., Richland, Wash.
W. L. Templeton.
Effluent and Water Treatment Journal Vol 11 No. 5, May 1971, p 251-258, 6 fig, 31 ref.

Descriptors: *Nuclear powerplants, *Effluents, *Waste disposal, *Water pollution, *Water pollution sources, Monitoring, Pesticides, Biocontrol, Biological properties, Cost-benefit theory, Seas.

Methods employed to assess the risks posed by radioactive waste disposal are discussed and their application to monitor the effects of other pollutants, such as pesticides, is considered. Special reference is made to the Windscale and Bradwell

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nuclear power station sites. The dissemination of pesticides, particularly the persistent chlorinated hydrocarbon compounds, is an analogous situation. Their attendant phenomena of dispersal, biological concentration, and concentration in food webs share many features with radionuclides. Like persistent pesticides, radionuclides become widely distributed in the environment, are concentrated at different rates in different species of plants and animals and can have widely different effects on different organisms. However, radio-nuclides are not taken up differentially—their accumulation rate depends on the normal uptake of the element, or chemically related element, and on the proportion of the isotope in the environment which is radioactive. The concentration factors of radionuclides in organisms and in food webs vary considerably, but are comparable to those of persistent insecticides. (Houser-ORNL) W72-10683

RADIUM IN AQUATIC FOOD CHAINS: RADIUM UPTAKE BY FRESH WATER ALGAE,
Atomic Energy of Canada Ltd., Chalk River (Ontario).
For primary bibliographic entry see Field 05C.
W72-10686

INDEXED BIBLIOGRAPHY ON ENVIRONMENTAL MONITORING FOR RADIOACTIVITY,
Oak Ridge National Lab., Tenn.
B. L. Houser.

Available from NTIS, as ORNL-NSIC-101 \$10.00 paper copy; \$0.95 microfiche. Report No. ORNL-NSIC-101, May 1972, 319 p.

Descriptors: *Bibliographies, *Monitoring, *Environment, *Assay, *Public health, *Abstracts, *Publications, Information retrieval, Surveys, Data collections, Measurement, Nuclear reactors, Nuclear wastes, Water pollution, Water pollution sources, Air pollution, Soil contamination, Analytical techniques, Instrumentation, Calibration.

Identifiers: Concentration, Background monitoring, Startup surveys, Operational surveys, Emergency monitoring.

This bibliography of over 850 abstracts on environmental monitoring for radioactivity is divided into six sections: preoperational surveys, surveys at startup, routine surveys during operation, analytical procedures, instrumentation including instrument calibration, and emergency monitoring. These references will provide background information that is necessary for the development of adequate monitoring programs. Important relationships that must be considered are: (1) determination of the critical radionuclides released, (2) the critical pathways to man of these radionuclides, and (3) the critical population groups exposed. (Houser-ORNL)
W72-10689

MOVEMENT OF TRITIUM IN ECOLOGICAL SYSTEMS,
California Univ., Livermore. Lawrence Radiation Lab.
J. J. Koranda, and J. R. Martin.
Available from NTIS, as UCRL-73178 \$3.00, \$0.95 microfiche. Report No. UCRL-73178, August 24, 1971, 56 p, 4 tab, 16 fig, 34 ref.

Descriptors: *Tritium, *Ecosystems, *Reviews, Nuclear wastes, Radioactivity effects, Forecasting, Systems analysis, Projections, Soil-water-plant relationships, Soil water movement, Water pollution control, Water circulation, Animal physiology, Path of pollutants, Public health, Plant physiology.

Although the world-wide exposure from fission-produced tritium by the year 2000 (0.008 milliard) is small local exposures may be substantially higher, depending on holdup in ecosystems. Turnover of tritiated water in plants, animals, and

ecosystems is reviewed. Important parameters include rates of turnover of soil water, half times of body or tissue water (minutes-hours in plants, 1-15 days in animals), and rates of organic fixation of tritium. (Bopp-ORNL) W72-10691

FISSION TRACK DATING OF VOLCANIC GLASS SHARDS IN MARINE SEDIMENTS,
Scripps Institution of Oceanography, La Jolla, Calif. Geological Research Div.
For primary bibliographic entry see Field 02J.
W72-10692

GAMMA EMITTERS IN EUPHAUSIIDS FROM THE SOUTHEAST PACIFIC OCEAN,
Chile Univ., Vina del Mar. Departamento de Oceanología; and Oregon State Univ., Corvallis.
T. J. Antezana, and S. W. Fowler.
Health Physics, Vol. 22, p 201-205 February, 1972 1 fig, 2 tab, 20 ref.

Descriptors: *Radioactivity, *Crustaceans, *Zinc radioisotopes, *Fallout, Pacific Ocean, Tropical regions, Atolls, Background radiation, Radioecology, Oceanography, Ocean circulation, Ocean currents, Vertical migration, Food chains, Nuclear explosions.

Zn-65 was found after French atomic tests in E. mucronata, a filterer of planktonic microorganisms which plays a role in regional food chains. The rather sudden disappearance of Zn-65 from the euphausiid during subsequent months (from about 40 pCi/g dry weight to near the 1 pCi/g background) is attributed to rapid northward transport of contaminated water by currents, diminishing fallout, euphausiid vertical migration, and molting of exoskeletons. (Bopp-ORNL) W72-10693

RELATIVE FLOW RATES OF SALT AND WATER IN SOIL,
California Univ., Davis. Dept. of Water Science.
For primary bibliographic entry see Field 02G.
W72-10712

SEEPAGE THROUGH SOIL BEDDING OR A HILLSIDE DUE TO A STEADY RAINFALL: I. SOIL SURFACE OF CONSTANT SLOPE,
Iowa State Univ. of Science and Technology, Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W72-10713

SEEPAGE THROUGH SOIL BEDDING OR A HILLSIDE DUE TO A STEADY RAINFALL: II. SOIL SURFACE OF ARBITRARY SHAPE,
Iowa State Univ. of Science and Technology, Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W72-10714

PRELIMINARY HYDROGEOLOGIC APPRAISAL OF NITRATE IN GROUND WATER AND STREAMS, SOUTHERN NASSAU COUNTY, LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
N. M. Perlmutter, and E. Koch.

Prof. Paper 800-B available from GPO, Washington, D C 20402 - Price \$2.25. In: Geological Survey Research 1972, Chapter B; U S Geological Survey Professional Paper 800-B, p B225-B235, 1972. 6 fig, 15 ref.

Descriptors: *Water pollution sources, *Nitrates, *New York, *Urban hydrology, *Path of pollutants, Hydrogeology, Groundwater movement, Farm wastes, Septic tanks, Sewers, Adsorption, Sorption, Domestic wastes, Soil disposal fields, Water quality, Urbanization.
Identifiers: *Nassau County (N Y), *Long Island (N Y).

Increase in nitrate content of groundwater and streams, mainly due to infiltration of sewage, leachate from chemical fertilizers, and wastes from decayed crops, is a major water-quality problem in a 180-square-mile area of Nassau County, Long Island, N. Y. This area has hydrologically similar adjoining sewered and unsewered parts. Nitrate content of water in the upper glacial aquifer averaged 30 mg/liter and in several places equaled or exceeded 100 mg/liter. In comparison, the estimated average natural nitrate content is less than 1 mg/liter. Nitrate content of groundwater-fed streams averaged 11 and 23 mg/liter in the sewered and unsewered areas, respectively. Nitrate-enriched water has also moved down into the underlying Magothy aquifer. For example, the nitrate content of water from 234 public-supply wells screened in the Magothy averaged 10 mg/liter, but in 16 wells the nitrate content ranged from 45 to 94 mg/liter. Reduction of nitrate to ammonium ion and subsequent ion exchange or sorption of the ammonium ion may retard southward movement of the 'nitrate front.' Increased pumping, however, could accelerate movement. (Knapp-USGS)
W72-10734

TRAVEL OF POLLUTION-INDICATOR BACTERIA THROUGH THE MAGOTHY AQUIFER, LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
J. Vecchioli, G. G. Ehrlich, and J. A. Ehlike.
Prof. Paper 800-B available from GPO, Washington, D C 20402 - Price \$2.25. In: Geological Survey Research 1972, Chapter B; U S Geological Survey Professional Paper 800-B, p B237-B239, 1972. 1 tab, 7 ref.

Descriptors: *Artificial recharge, *Reclaimed water, *Water reuse, *Waste water disposal, *Injection wells, New York, Water quality, Path of pollutants, Bacteria, Coliforms, Filtration, Aquifer characteristics, Sewage treatment, Hydrogeology.

Identifiers: *Long Island (N Y).

Experimental injection of reclaimed water (highly treated but unchlorinated sewage) into the Magothy aquifer at Bay Park, Long Island, N. Y., showed very restricted travel of pollution-indicator bacteria. Although the injected water had substantial densities of total-coliform, fecal-coliform, and fecal-streptococci, no fecal-coliform or fecal-streptococcal bacteria and only nominal total coliform bacteria were found in water from an observation well 20 feet away from the point of injection. Restriction of bacterial travel through the Magothy aquifer is due primarily to the high filter efficiency of the fine to medium sand characteristic of the aquifer and to bacterial capture by a filter mat and slime deposits that form around the injection well during injection. (Knapp-USGS)
W72-10735

MICROBIOLOGICAL ASPECTS OF GROUND-WATER RECHARGE-INJECTION OF PURIFIED CHLORINATED SEWAGE EFFLUENT,
Geological Survey, Menlo Park, Calif.
G. G. Ehrlich, T. A. Ehlike, and J. Vecchioli.
Prof. Paper 800-B available from GPO, Washington, D C 20402 - Price \$2.25. In: Geological Survey Research 1972, Chapter B; U S Geological Survey Professional Paper 800-B, p B241-B245, 1972. 2 fig, 3 tab, 16 ref.

Descriptors: *Artificial recharge, *Reclaimed water, *Water reuse, *Waste water disposal, *Injection wells, New York, Water quality, Path of pollutants, Bacteria, Coliforms, Filtration, Aquifer characteristics, Sewage treatment, Hydrogeology.

Identifiers: *Long Island (N Y).

Chlorinated, purified sewage was injected through a well at Bay Park, N.Y., at rates of 350 gpm (gallons per minute) and 200 gpm for 33 days. Observed injection-well head buildup was correlated with the content of mostly inorganic particulate

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources of Pollution

matter in the injectant. Bacterial slimes were not present in repumped water or in a sand probe placed near the injection zone during the test. Several species of aerobic and facultative anaerobic bacteria were found in repumped water samples. Microbial growth occurs in the aquifer after chlorine has been inactivated by the aquifer materials. (Knapp-USGS)
W72-10736

CORROSION OF WELL-CASING AND SCREEN METALS IN WATER FROM THE MAGOTHY AQUIFER AND IN INJECTED RECLAIMED WATER, BAY PARK, LONG ISLAND, NEW YORK,

Geological Survey, Mineola, N.Y.

J. Vecchioli, and A. A. Giacomo.
Prof. Paper 800-B available from GPO, Washington, DC 20402 - Price \$2.25. In: Geological Survey Research 1972, Chapter B; US Geological Survey Professional Paper 800-B, p B247-B251, 1972. 5 fig, 1 tab, 8 ref.

Descriptors: *Corrosion, *Well screens, *Reclaimed water, *Injection wells, *Well casings, New York, Water wells, Water reuse, Waste water treatment, Waste water disposal, Bacteria, Water quality, Sulfur bacteria, Iron bacteria.
Identifiers: *Long Island (N Y).

Short-term (1- to 5-month) corrosion rates were determined for mild steel, stainless steel, and copper in contact with both water from the Magothy aquifer and injected reclaimed water. Only mild steel showed significant corrosion. Average corrosion rates for mild steel were 0.003 and 0.007 inch per year penetration for water from the Magothy aquifer and reclaimed water, respectively. The corrosion rates indicate that water from both sources is moderately corrosive to mild steel. Although corrosion rates were somewhat higher in reclaimed water than in Magothy water, electrochemical relationships show that water from the Magothy aquifer is more undersaturated with ferrous iron and, thus, is potentially more corrosive than reclaimed water. Higher rates of corrosion in reclaimed water are attributed to catalytic action of sulfate-reducing bacteria. (Knapp-USGS)
W72-10737

TRITIUM IN PINE TREES FROM SELECTED LOCATIONS IN THE UNITED STATES, INCLUDING AREAS NEAR NUCLEAR FACILITIES,

Geological Survey, Amherst, Mass.
G. L. Stewart, T. A. Wyerman, M. Sherman, and R. Schneider.
Prof. paper 800-B available from GPO, Washington, DC 20402 - Price \$2.25. Geological Survey Research 1972, Chapter B; US Geological Survey Professional Paper 800-B, p B265-B271, 1972. 4 fig, 2 tab, 7 ref.

Descriptors: *Tritium, *Pine trees, *Fallout, *Nuclear powerplants, Meteorology, Distribution patterns, Nuclear explosions.

Pine needles were sampled at several selected locations in the conterminous United States to determine if the natural tritium rainout pattern can be correlated with tritium in free water and in bound hydroxyls of new and old growth. Near nuclear facilities which are known to release tritium to the environment the objectives was to obtain some information on the distribution pattern and fate of tritium in nearby vegetation. Excluding samples near the nuclear facilities, the tritium concentrations in pine needles followed a geographic pattern similar to that for the rainout of bomb-produced tritium—a general increase with latitude and distance from the ocean. However, tritium concentrations were greater in plant tissue than would be expected from natural rainout. At the Savannah River Plant, South Carolina, the data clearly indicate a decreasing concentration of tritium with distance from the release areas. (Knapp-USGS)
W72-10741

CONTRIBUTIONS TO THE GENESIS AND CLASSIFICATION OF MARSH SOILS: III. CONTENTS, OXIDATION STATUS AND MECHANISMS OF BINDING OF SULFUR IN POLER SOILS, (IN GERMAN),

Kiel Univ. (West Germany). Institut fuer Pflanzenernährung und Bodenkunde.

For primary bibliographic entry see Field 02G.
W72-10787

INSECTICIDE RESIDUES IN A STREAM AND A CONTROLLED DRAINAGE SYSTEM IN AGRICULTURAL AREAS OF SOUTHWESTERN ONTARIO, 1970,

Department of Agriculture, London (Ontario).

J. R. W. Miles, and C. R. Harris.
Pesticides Monitoring Journal, Vol. 5, No. 3, p 289-294, December 1971. 1 fig, 6 tab, 13 ref.

Descriptors: *Path of pollutants, *Pesticide kinetics, *Pesticide residues, *DDT, *Fish physiology, Pesticide drift, Absorption, Agricultural chemicals, DDD, DDE, Dieldrin, Lake Erie, Water pollution sources, Water pollution effects, Public health, Chlorinated hydrocarbon pesticides, Canada.
Identifiers: *Residue magnification, *Residue concentration, Ontario.

Residues of the organochlorine insecticides, primarily DDT and its metabolites, and to a lesser extent dieldrin, are present in streams and ditches draining agricultural areas whose soil contains residues of these insecticides. While the residue concentrations found in this study of a creek flowing into Lake Erie and a controlled drainage system were extremely small and were below maximum reasonable stream allowances, residues in the mud were 820 to 13,000 times the concentrations in the water. Residues found in the fish were 50,000 to 80,000 times those in the water, thus indicating magnification as the insecticides move up through the biological chain. (LeGore-Washington)
W72-10798

MOBILIZATION OF MERCURIC SULFIDE FROM SEDIMENT INTO FISH UNDER AEROBIC CONDITIONS,

Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst.

D. C. Gillespie, and D. P. Scott.
Journal of the Fisheries Research Board of Canada, Vol. 28, No. 11, p 1807-1808, 1971. 2 fig, 4 ref.

Descriptors: *Path of pollutants, *Mercury, *Absorption, *Fish physiology, *Physiological ecology, Metals, Public health, Water pollution effects, Water pollution sources, Environmental effects.
Identifiers: Mercuric sulfide, Guppies, Poecilia spp.

Pollution of the aquatic environment with mercury and the subsequent high concentrations in fish have resulted in the need for model experiments to examine the process of transfer of mercury from sediments to fish. A system for studying the aerobic mobilization of mercury from aquatic sediments into fish is described. Using this method, it was shown that mercuric sulfide in sediment is very slowly mobilized and picked up by fish. (LeGore-Washington)
W72-10799

FATE OF THERMALLY POLLUTED SURFACE WATER IN RIVERS,

Utah State Univ., Logan. Dept. of Civil Engineering.

Cheng-jung Chen.
Journal of the Sanitary Engineering Division, American Society of Civil Engineers, Vol 97, No SA3, Proc Paper 8197, p 311-331, June 1971. 1 fig, 21 ref.

Descriptors: Rivers, *Heated water, *Thermal pollution, Diffusion, *Dispersion, Heating, Mathe-

matical models, Temperature, Water distribution, Flow, Water supply, *Path of pollutants.
Identifiers: *Thermal energy, Space averaging.

By means of the time and space-averaging processes, the general longitudinal thermal energy equation for nonuniform flow can be derived from the three-dimensional instantaneous equations of continuity and of thermal energy for flow of incompressible Newtonian fluid. The longitudinal thermal energy equation can be used to describe mathematically the average temperature distribution of a stream at every instant and at all points due to the injection of thermal pollutant in the stream, provided that the longitudinal heat dispersion coefficient of water, the average thermal convective conduction coefficients of the water surface and the soil surface, and the Darcy-Weisbach friction coefficient of the stream can accurately be evaluated. The values of such coefficients depend primarily on the flow and the thermal properties of water as well as its boundaries in contact with soil and air, and should be able to be expressed in terms of the bulk flow parameters and boundary geometries. The so-called exponential temperature decay equation can readily be formulated by simplifying the longitudinal thermal energy equation in uniform flow on the basis of the assumption that at the equilibrium state there is no longitudinal mixing in a stream. (Upadhyaya-Vanderbilt)
W72-10819

AIRBORNE SCANNER TRACES THERMAL POLLUTION,

Abrams Aerial Survey Corp., Lansing, Mich.

T. M. Schafer.
Public Works, p 58-59, August 1971. 3 photos.

Descriptors: *Remote sensing, *Thermal pollution, Temperature, Oil spills, Soil types, Geological surveys, Photography, Lakes, Rivers.
Identifiers: *Infrared scanner.

An airborne scanning system traces thermal discharges into lakes and rivers. Temperature variances on the order of 1°F are measurable from 2000 foot altitude overflights. The scan technique is simple and inexpensive. An airborne radiometer can be employed with the scanner if absolute temperature readings are desired. Weather restrictions for the actual flight are much less stringent than for aerial photo surveys since no exposing sunlight is needed. A second station in the same aircraft adds the capability of simultaneous precision cartographic aerial photography. Some tests suggest that water-bearing soil types, such as muck deposits, can be detected by the scanner, which would give the technique major significance in highway route selection. Oil slicks on the surface of water have been plotted from infrared scans since their thermal emissivity is different than that of the surrounding water. Mineral surveying, geological fault mapping, construction surveys, forest fire patrols and crop health surveys all seem to be likely applications for thermal imagery techniques. (Upadhyaya-Vanderbilt)
W72-10820

FORMATION OF THE THERMOCLINE STEP STRUCTURE BY LARGE-AMPLITUDE INTERNAL GRAVITY WAVES,

Environmental Science Services Administration, Princeton, N.J. Geophysical Fluid Dynamics Lab.

For primary bibliographic entry see Field 02E.
W72-10822

INVESTIGATION OF THE BOUGUER-LAMBERT FORMULA FOR THE PENETRATION OF SOLAR RADIATION INTO ICE,

Kazakhskii Nauchno-Issledovatel'skii

Gidrometeorologicheskii Institut, Alma-Ata (USSR).

For primary bibliographic entry see Field 02C.
W72-10823

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Sources of Pollution—Group 5B

PRELIMINARY SURVEY OF CONCENTRATION OF FLUORINE IN POTABLE WATER IN NORTHERN BIHAR,
 Indian Veterinary Research Inst., Izatnagar.
 P. N. Johri, and J. P. Srivastava.
 Indian J Agric Sci, Vol 40, No 12, p 1128-1130, 1970.
 Identifiers: *Fluorine, *India, *Potable water, Surveys.

A survey was carried out of the F1 content in potable water of 7 districts of northern Bihar. Well-water generally contained higher concentration of F1 than surface water. The concentration of F1 in waters collected from different wells of the same village varied. No water sample contained a toxic level of F1.—Copyright 1972, Biological Abstracts, Inc.
 W72-10824

DISCHARGE OF COOLING WATER FROM THERMAL POWER PLANTS (KYLVATTENUT-SLAPP FRAN VARMEKRAFTVERK),
 Chalmers Univ. of Technology, Goteborg (Sweden).
 K. Cederwall, and A. Sjoberg.

Sartryck ur Vag-och Vattenbyggnaren, No 8-9, 1969. 15 p, 11 fig, 13 ref. English summary.

Descriptors: *Thermal pollution, Cooling water, Nuclear powerplants, Water spreading, Density, Diffusivity, Discharge (Water), Coasts, Sea water, Mathematical models, *Model studies.
 Identifiers: *Coastal water, *Subsurface jet.

Thermal pollution of the sea water and recirculation of the discharged cooling water are two of the main problems in design and operation of thermal power plants on the sea coast. These problems are affected by distance between intake and outlet, the heat budget of the sea, the hydrography and currents of the sea, and the spreading behavior of the warm water. The relative growth of the flow of cooling water, the relative excess of temperature, and the relative velocity at the flow axis are the parameters which express spread characteristics of the heated waters. A mathematical model for the initial flow zone is developed introducing the following assumptions: the discharged flow of cooling water is considered as a subsurface jet; the water surface and the bottom are characterized by zero rate of entrainment; the local flux of momentum is reduced due to the work done by turbulent shear at the fixed boundaries; and increased lateral spread is caused by the density deficit of the cooling water. Equations for the spreading of cooling water from a subsurface jet in deep or shallow homogeneous water, stagnant water, and a flowing recipient are developed. Proposed flow models are applied to two planned 3000 Mw nuclear powerplants, both with cooling water discharges of about 150 cubic meter per sec. initially issued at a speed of 2 meter per sec. (Upadhyaya-Vanderbilt)
 W72-10826

TWO-DIMENSIONAL SURFACE WARM JETS,
 Tetra Tech, Inc., Pasadena, Calif.
 C. Y. Koh.
 Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 97, No HY6, Proc Paper 8186, p 819-836, June 1971. 6 fig, 4 ref.

Descriptors: *Jets, *Entrainment, Heat transfer, Hydraulics, Interfaces, Shear, *Thermal pollution, Water quality, Hydraulic jump, Heated water, *Dispersion.
 Identifiers: *Surface jets, *Two-dimensional.

The dispersion of heat resulting from the horizontal discharge of a two-dimensional warm jet at the surface into a quiescent cooler ambient is investigated. The effects of source momentum, source buoyancy, entrainment, and interfacial shear are included. The case of an infinite ambient fluid is examined and it is found that the surface heat exchange mechanism can replace the necessary downstream conditions. In the event no sur-

face exchange occurs such as in the case where the buoyancy is induced by salinity variations, no steady-state solution can be expected unless the interfacial shear is ignored. For given conditions, there exist two critical values for the surface heat exchange coefficient K such that if the actual value of K is larger than the one, the flow field is of jet type; if K is less than the other, the source is inundated; and if K is between the two, the flow field consists of a jet type region near the source, followed by an internal hydraulic jump and a region resembling two-layered stratified flow. This finding is of importance for design considerations. (Upadhyaya-Vanderbilt)
 W72-10828

CONDENSER COOLING AND PUMPED STORAGE RESERVOIRS,
 Main (Chas. T.), Inc., Boston, Mass. Thermal Power Group.
 For primary bibliographic entry see Field 05G.
 W72-10830

A STUDY OF THE MIXING OF HEAT STRATIFIED FLOW UNDER VARYING TURBULENCE CONDITIONS WITH APPLICATION TO THE REDUCTION OF RIVER HEAT POLLUTION,
 Connecticut Univ., Storrs.

A. L. Prasuhn.
 Available from University Microfilms, Ann Arbor, Mich., 48106, Xerox Copy, \$6.20, Microfilm \$3.00, Order No. 69-2170. Ph.D. Dissertation, 1968. 118 p, 4 plates, 39 fig, 3 tab, 38 ref. OWRR A-011-CONN (2).

Descriptors: *Mixing, *Thermal stratification, Air temperature, *Turbulence, Boundary layers, Streams, Mathematical models, Hydraulic models, Currents, *Thermal pollution.
 Identifiers: Wind tunnel models.

A two-dimensional, heat-stratified air flow was studied. The mixing rate that occurred when the floor of the tunnel was roughened could be compared both with the turbulence level of the flow and with the mixing rate of a similar flow over a smooth boundary. By consideration of other studies in air flows, laboratory flumes, and natural streams, inferences are made relating the presented results to river conditions. The mixing of the two-layered flow could be expressed by a constant for flow over the smooth floor. Large increases in the diffusion coefficients, which implies accelerated mixing rates, can be accomplished by roughening of a boundary. (Upadhyaya-Vanderbilt)
 W72-10833

LAKE MICHIGAN OPEN WATER AND LAKE BED SURVEY 1970.
 Illinois State Environmental Protection Agency, Springfield.
 For primary bibliographic entry see Field 05A.
 W72-10850

PROCEEDINGS OF FIRST MEETING ON ENVIRONMENTAL POLLUTION, 15-16 APRIL 1970, SPONSORED BY AMERICAN ORDNANCE ASSOCIATION.
 Edgewood Arsenal, Md.
 For primary bibliographic entry see Field 05D.
 W72-10874

TOXICITY AND DISTRIBUTION OF AROCLOR 1254 IN THE PINK SHRIMP PENAEUS DUORARUM,
 Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Lab.
 For primary bibliographic entry see Field 05C.
 W72-10876

TOPLYR-II A TWO-DIMENSIONAL THERMAL-ENERGY TRANSPORT CODE,
 Hanford Engineering Development Lab., Richland, Wash.
 D. C. Kolesar, and J. C. Sonnichsen, Jr.
 Report HEDL-TME 72-46, March 1972. 72 p, 16 fig, 25 ref, 2 append. USAEC Contract AT (45-1)-2170.

Descriptors: *Thermal pollution, *Electric powerplants, *Thermal water, Thermal properties, Computer models, Hydrologic data, Streamflow, Input-output analysis, Equations, Correlations analysis, Forecasting, Water pollution sources.
 Identifiers: Thermal receiving waters.

The TOPLYR codes are designed to estimate the transport and persistence of powerplant thermal discharges in receiving waters. TOPLYR-II is a modification and improvement of the TOPLYR-I digital computer code and was designed for testing the TOPLYR model against field data. TOPLYR-II is an improvement in that the numerical approximations involve equations known to be accurate to second order, rather than first order, as used in TOPLYR-I. A necessary requisite for the field data used to test the code is adequate definition in space and time of receiving water depth, velocity, and temperature throughout the flow field. U.S. Geological Survey data on eight river sites near heat sources were used. The code was fashioned for ease of input of these data and for suitable output for direct comparison. Ease in adaptation of the code to other problems was considered in the design. (Woodard-USGS)
 W72-10892

EVALUATION OF SALT WATER DISPOSAL INTO POTENTIAL GROUND-WATER RESOURCES,
 Oklahoma Corp., Commission, Oklahoma City, F. A. Norris.

Copy available from GPO Sup Doc EP2.10:16060 HJ 02/72, \$0.35; microfiche from NTIS as PB-210 852, \$0.95. Environmental Protection Agency Water Pollution Control Research Series, February 1972. 18 p, 1 fig, 1 tab, 17 ref. EPA Project 16060HJ 02/72.

Descriptors: *Water quality, *Aquifer characteristics, *Hydrogeology, *Oklahoma, *Water sources, Sandstones, Saline water, Aquifer testing, Injection wells, Waste disposal wells.
 Identifiers: *Glorietta Formation (Okla).

The quality of the water in the Glorieta Formation in western Oklahoma was tested by sampling an oil test well. The test was made to obtain data which would be used in evaluating the potential of the formation as a water source or for brine disposal. The water in the formation is high in dissolved solids and would have to be either desalinated or mixed with a high proportion of good-quality water before the water could be used for such purposes as irrigation or municipal supply. The Glorieta Formation is composed of very fine unconsolidated sand. Completion and pumping of water wells in the formation would be difficult and considerably more expensive than present water wells in the High Plains area. (Knapp-USGS)
 W72-10895

PRELIMINARY INVESTIGATIONS OF PETROLEUM SPILLAGE, HAINES-FAIRBANKS MILITARY PIPELINE, ALASKA,
 Cold Regions Research and Engineering Lab., Hanover, N.H. Earth Sciences Div.
 For primary bibliographic entry see Field 05C.
 W72-10909

PREDICTED DISTRIBUTION OF ORGANIC CHEMICALS IN SOLUTION AND ADSORBED AS A FUNCTION OF POSITION AND TIME

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources of Pollution

FOR VARIOUS CHEMICAL AND SOIL PROPERTIES,
California Univ., Riverside. Dept. of Mathematics; and California Univ., Riverside. Dept. of Soils and Plant Nutrition.
J. K. Oddson, J. Letey, and L. V. Weeks.
Soil Science Society of America Proceedings, Vol 34, No. 3, p 412-417, May-June 1970. 4 fig, 10 ref. OWRR B-072-CAL (6).

Descriptors: *Water pollution sources, *Pesticides, *Soil water movement, *Mathematical studies, Forecasting, Soil properties, Organic pesticides, Surfactants, Infiltration, Adsorption, Chemical properties, Equations.

When organic chemicals such as pesticides and surfactants are applied to soils, water through rainfall or irrigation causes these chemicals to move into and through the soil profile. Most organic chemicals are adsorbed to a certain extent by the soil. The effectiveness of a given organic chemical is dependent, in part, upon its position in the soil profile and whether it is adsorbed or in solution. Equations were developed to predict the concentration in solution and adsorbed as a function of position and time for various organic chemicals and soil types after irrigation or rainfall. K (constant) influences the depth of maximum concentration of organic in solution but does not affect the value of the concentration. The organic chemical will move in solution as a wave through the soil. The lower K, the more spread out the wave will be. The depth of movement of maximum concentration is equal to the depth of water penetration divided by K. The concentration of material adsorbed on the soil also moves down as a wave. The position of maximum adsorbed concentration is about the same as for the maximum concentration in solution. Increasing K causes an increase in concentration of adsorbed material. (Woodard-USGS)
W72-10914

FIELD AND LABORATORY METHODS USED BY THE GEOLOGICAL SURVEY OF CANADA IN GEOCHEMICAL SURVEYS: NO. II. URANIUM IN SOIL, STREAM SEDIMENT AND WATER,
Geological Survey of Canada, Ottawa (Ontario).
For primary bibliographic entry see Field 02K.
W72-10917

EFFECT OF WATER CONDITIONING ON WASTEWATER QUALITY,
Orange County Flood Control District, Santa Ana, Calif.
For primary bibliographic entry see Field 05F.
W72-10921

TRANSPORT OF H2O18 INTO MAIZE LEAVES UNDER VARIOUS CONDITIONS OF ANAEROBOSIS, (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Inst. of Plant Physiology.
For primary bibliographic entry see Field 03F.
W72-10936

POLLUTION OF THE MOJI-GUACU RIVER: I. PROBLEMS CAUSED BY THE BACTERIA SPHAEROTILUS NATANS, (IN PORTUGUESE),
Estacao Experimental de Biologia e Piscicultura, Pirassununga (Brazil).
M. P. De Godoy.
Cien Cult. Vol 23, No 2, p 199-204. 1971. Illus. English summary.
Identifiers: *Bacteria, Brazil, Environment, Fish, *Moji-Guacu River, *Water pollution effects, Sao Paulo, Sewage, Sphaerotilus natans.

S. natans, an iron-bacterium was identified as being responsible for the problems involving water quality in the Moji-Guacu river and problems with catches of fish. Nets put into the river were covered in a few hours, with bacteria in the form

of thousands of filamentary flakes. The verification of this bacterium dated from 1965; in the last 2 years (1969-1970) a great increase of this bacterium was observed between April and Sept., since the river was very low. The Moji-Guacu river is classified as a polluted river by the Sao Paulo State Government (it receives natural sewage from all municipalities in the Mojan basin and water from small and large industries). Biologically, it presents a meso-saprobic environment in many places during part of the year (April to Sept.).—Copyright 1972, Biological Abstracts, Inc.
W72-10938

RADIATION MEASUREMENT,
Atmospheric Environment Service, Ottawa (Ontario).
For primary bibliographic entry see Field 05A.
W72-10945

RADIOECOLOGY APPLIED TO THE PROTECTION OF MAN AND HIS ENVIRONMENT (SUMMARY),
European Communities, Luxembourg. Commission.

Presented at the Commission of the European Communities International Symposium Radioecology Applied to the Protection of Man and his Environment, Rome, Sept. 1971.

Descriptors: *Radioecology, *Ecology, *Fallout, *Biology, *Air pollution, *Water pollution, *Water pollution sources, *Public health, Radioactivity effects, Monitoring, Meteorology, Path of pollutant, Transfer, Environment.

Safeguarding and planning the environment, ecology and health protection now occupy a predominant place in the preoccupations of public health officials and scientists. One of the great pollution problems which has arisen in the past 25 years is radioactive contamination of the environment. The skill displayed in mastering the risks of radioactive contamination has shown that it is possible, not only on a realistic basis but also with adequate guarantees from the point of view of public health, to protect man and his environment without standing in the way of scientific and technical progress. It is right to stress the remarkable development in recent years of the study of fundamental and applied radioecology. The results have undoubtedly benefited the practical organisation of radiological protection. Furthermore, the experience acquired in these two disciplines, which are closely associated in the pursuit and realisation of the common aim of prevention and monitoring, may be taken as an example and often as a model in regard to principles and methods in non-radioactive pollution control. An attempt is made to group together papers originating from different scientific fields, since the problems to be examined are many and complex. (See W72-10947 thru W72-10973) (Houser-ORNL)
W72-10946

STRONTIUM CONCENTRATION FACTORS IN BIOTA AND BOTTOM SEDIMENTS OF A FRESHWATER LAKE,

Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
I. L. Ophel, C. D. Fraser, and J. M. Judd.
Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 17 p 13 ref, 4 tab.

Descriptors: *Strontium radioisotopes, *Freshwater fish, *Aquatic plants, *Absorption, Strontium, Water analysis, Path of pollutants, Nuclear wastes, On-site investigations, Canada, Sediments, Lakes.

A small, shallow brown-water lake had been contaminated with low levels of Sr-90 (specific activi-

ty 10-14 dpm/microg Sr) for 15 years. The specific activity of the upper 10 cm of bottom sediments was half that in biota and water. The Sr content of the sediments correlated with their organic content. The concentration factors (on a fresh weight basis) of six species of fish ranged from 450-1250; of 22 species of aquatic plants, from 30-1300. Each species exhibited a characteristic Sr concentration. (See also W72-10946) (Bopp-ORNL)
W72-10948

BEHAVIOUR OF REACTOR EFFLUENTS ACTIVITIES IN THE PRODUCTION OF SEA SALT BY SOLAR EVAPORATION,
Bhabha Atomic Research Centre, Bombay (India).
B. M. Sankhesara, and P. R. Kamath.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 11 p, 4 tab, 2 ref.

Descriptors: *Nuclear powerplants, *Radioactivity effects, *Strontium radioisotopes, *Path of pollutants, Environmental effects, Radioecology, Nuclear wastes, Absorption, Effluents, Public health, Systems analysis, Food chains, Asia, Zinc radioisotopes.
Identifiers: Manganese radioisotopes, India, Cesium radioisotopes, Ruthenium radioisotopes, Yttrium radioisotopes.

A critical pathway of radioisotopes from the Bhabha Atomic Research Centre and Tarapur nuclear powerplant effluent outfalls is the manufacture of salt by solar evaporation. The critical radioisotope is Sr-90 which is retained significantly in the salt as the sulphate. This pathway is of comparable importance to that for Sr-90 through fish consumption. (See also W72-10946) (Bopp-ORNL)
W72-10949

CONTAMINATION OF THE SOIL WITH MERCURY,
European Atomic Energy Community, Petten (Netherlands). Joint Nuclear Research Center; and European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center; and Reactor Centrum Nederland, Petten.

M. J. Frissel, P. Poestra, P. Reiniger, and H. A. Das.
Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 14 p, 4 fig, 2 tab, 6 ref.

Descriptors: *Mercury, *Soil contamination, *Radioactivity techniques, *Tracers, Path of pollutants, Europe, Radioecology, Environmental effects, Infiltration, Water pollution sources, Potable water, Groundwater, Surface water, Mass transfer.

From analyses of soil samples from 2 sites known to have been contaminated with mercury from treatments in the bulb fields during the last 20 years, it is tentatively concluded that the mercury either evaporated or was transported beyond a depth of 2 meters. Gaseous transport of dimethylmercury was studied in the laboratory, and the data fitted to a computer program (available at request). Independent determinations of the parameters are being made. Laboratory studies of methylmercury chloride transport indicate that it is transported downwards by rain, and that vapor movement under the influence of a temperature gradient is small. (See also W72-10946) (Bopp-ORNL)
W72-10950

INTERACTION BETWEEN WATER, TRACE ELEMENTS AND DIFFERENT COMPONENTS IN THE DANUBE RIVER,
Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia).

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Sources of Pollution—Group 5B

R. Draskovic, R. Radosavljevic, T. Tasovac, and M. Zaric.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 7 p, 27 ref.

Descriptors: *Nuclear wastes, *Rivers, *Water quality, Radioecology, Path of pollutants, Cobalt radioisotopes, Absorption, Sediments, Sediment transport, Reviews, Plankton, Fish, Seasonal, Diurnal, Water pollution effects, Tracers, Physicochemical properties, Water quality standards, Radioisotopes.

Identifiers: Danube River.

Work on both radioactive and non-radioactive river pollution is reviewed. Radioactive corrosion products from a Bavarian nuclear powerplant were high in the Danube during Oct.-Dec. 1966 and April-July 1967. The effect of hydrological and chemical conditions was studied on uptake of radionuclides (Cs-137, Co-60, Zr-95, Nb-95, Ru-106, and others) by suspended and bottom sediments, plankton, fish, and other biota. Injection of radioactive tracers was used to measure sediment transport. Water quality criteria for aquatic life vary between localities and depend on season and time of day. (See also W72-10946) (Bopp-ORNL) W72-10951

TRITIUM SECRETION INTO COW'S MILK AFTER ADMINISTRATION OF ORGANICALLY BOUND TRITIUM AND OF TRITIATED WATER,

Agricultural Univ., Wageningen (Netherlands); and Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).

J. Van Den Hoek, and R. Kirchmann.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 12 p, 3 fig, 2 tab, 6 ref.

Descriptors: *Milk, *Tritium, *Absorption, *Nuclear wastes, Path of pollutants, Food chains, Systems analysis, Forages, Public health, Environmental effects, Radioecology.

Tritium (a potential pollutant from the nuclear industry which may enter food chains through uptake by plants) was administered to lactating cows as tritiated organic constituents in hay which had been contaminated during growth. The biological half life of tritium in organic milk constituents was about two days initially, but much slower components became predominant after about one week. Probably this results from slow turnover of tritium which becomes incorporated into the animal's tissues. (See also W72-10946) (Bopp-ORNL) W72-10952

A METHOD TO STUDY THE HISTORY OF ANY PERSISTENT POLLUTION IN A LAKE BY THE CONCENTRATION OF CS-137 FROM FALLOUT,

European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

O. Ravera, and G. Premazzi.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 16 p, 5 fig, 4 tab, 16 ref.

Descriptors: *Sedimentation, *Lakes, *Radioisotopes, *Cesium, *Fallout, Path of pollutants, Nuclear wastes, Radioecology, Europe, Environmental effects, Heavy metals, Water pollution, Analytical techniques, Sedimentation rates, Testing, On-site investigations.

Identifiers: Cesium radioisotopes, Lake Varese (Italy).

Sedimentation rates (0.3-2 cm/year) were estimated for 5 lakes in Northern Italy from the vertical distribution in sediment of Cs-137. For 4 of the lakes, Cs-137 increased with sedimentation rate and with a decrease in renewal time. For 3 lakes with a small sedimentation rate, the pattern in sediment differed from the fallout pattern in past years, probably from the activity of benthic organisms. The data are being used in research on the history of chromium and cobalt pollution of Lake Varese. (See also W72-10946) (Bopp-ORNL) W72-10953

DETERMINATION OF THE MAXIMUM PERMISSIBLE CONCENTRATION OF RA-226 IN WATER IN THE PRESENCE OF SULPHATES,

Controle Radioprotection, Brussels (Belgium); and Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).

R. Boulenger, G. Koch, C. Weyers, A. Gerard, and J. Baton.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 19 p, 7 tab, 5 ref.

Descriptors: *Radium radioisotopes, *Calcium sulfate, *Radiochemical analysis, *Sulfates, Solubility, Path of pollutants, Water pollution effects, Systems analysis, Radioecology, Analytical techniques, Absorption, Toxicity, Public health, Potable water, Bioindicators.

In contaminated water, where the presence of calcium and sulphate can lead to precipitation of calcium sulphate, Ra-226 must be considered to be in soluble form such that the maximum permissible concentration for potable water is that for soluble Ra-226. When radium sulphate was mixed with a solution containing calcium ion, little Ra-226 was carried into the precipitate. When the radium was placed in the stomachs of rats as a calcium sulphate suspension, nearly the same biological availability was measured as for the bromide. (See also W72-10946) (Bopp-ORNL) W72-10954

RADIOECOLOGY AND CHEMOECOLOGY IN THE SERVICE OF THE PROTECTION OF NATURE,

Institute of Biology of the Southern Seas, Sevastopol (USSR).

G. G. Polikarpov, L. G. Kulebakina, V. G. Tsitsigina, and V. V. Andrudtschenko.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 6 p, 1 tab, 14 ref.

Descriptors: *Radioisotopes, *Absorption, *Environmental effects, Nuclear wastes, Path of pollutants, Marine algae, Chromosomes, Embryonic growth stage, Crustaceans, Monitoring, Water pollution effects, Mollusks.

Identifiers: Black Sea.

Concentration factors for Sr-90 uptake in the Black Sea are 60-250 for brown algae and 70-300 for molluscs and crustaceans. Incubation of marine organisms in radioactive solutions increases chromosomal aberrations. Lethal DDT concentrations in seawater are 0.1 mg/liter for an alga and 0.01 mg/liter for a crustacean. (See also W72-10946) (Bopp-ORNL) W72-10955

PATHWAYS FOR THE TRANSFER OF RADIONUCLIDES FROM NUCLEAR POWER REACTORS THROUGH THE ENVIRONMENT TO MAN,

Environmental Protection Agency, Cincinnati, Ohio. Radiochemistry and Nuclear Engineering Branch.

R. L. Blanchard, and B. Kahn.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 14 p, 12 tab, 16 ref.

Descriptors: *Nuclear powerplants, *Nuclear wastes, *Radioisotopes, *Absorption, Path of pollutants, Radioactivity, Public health, Potable water, Rivers, Water pollution, Food chains, Radioecology, Regulation, Federal government, Systems analysis, Iodine radioisotopes, Illinois, Massachusetts.

In the vicinity of the Dresden and the Yankee nuclear powerplants, very low radiation dose rates result via atmospheric-discharge pathways (external radiation, grass-cattle-milk-man, leafy vegetables-man, grass-cattle-beef-man, inhalation) or aqueous-discharge pathways (river-fish-man, river-drinking water-man). With the fish consumption pathway, the very high concentration factor (30,000) for niobium makes Nb-95 the critical radionuclide when solubility considerations are neglected. At both Dresden and Yankee the critical pathway is external radiation. The second most critical pathway at Dresden is I-131 in drinking water; at Yankee, Nb-95 from consumption of fish. (See also W72-10946) (Bopp-ORNL) W72-10956

ZINC AND COBALT UPTAKE BY THE BROWN SEAWEED FUCUS SPIRALIS (L.),

Reactor Centrum Nederland, Petten.

A. W. Van Weers.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 11 p, 5 fig, 5 ref.

Descriptors: *Zinc radioisotopes, *Cobalt radioisotopes, *Marine algae, Heavy metals, Absorption, Bioindicators, Path of pollutants, Food chains, Nuclear wastes, Environmental effects, Effluents, Monitoring, Chelation.

Hazards from uptake of both radioactive and non-radioactive, heavy-metal pollutants were studied; and a biological indicator of pollution was evaluated. Addition of 500 ppb of stable Co reduced the concentration factor for Co-60 uptake (measured after 6 days) from about 350 to 60; 500 ppb of stable Zn reduced the concentration factor for Zn-65 from about 1000 to 300. A chelating agent (EDTA) reduced uptake of Zn-65 to 10% of the control at an EDTA concentration of 1 micromole/liter; a similar reduction of Co-60 uptake occurred at an EDTA concentration of 30 micromoles/liter. A seasonal variation in the Zn content of seaweed observed over a period of several years is probably related to its growth cycle. (See also W72-10946) (Bopp-ORNL) W72-10957

INDICATOR BASED SURVEILLANCE PROGRAM (MARINE) AT A NUCLEAR SITE,

Bhabha Atomic Research Centre, Bombay (India).

Health Physics Div.

I. S. Bhat, and P. R. Kamath.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 13 p, 4 tab, 6 ref.

Descriptors: *Iodine radioisotopes, *Cesium radioisotopes, *Cobalt radioisotopes, *Bioindicators, Analytical techniques, Pollutant identification, Nuclear powerplants, Effluents, Nuclear wastes, Path of pollutants, Asia, Marine algae, Sediments, Estuarine environment, Monitoring, Crabs, Shrimp.

Identifiers: India, Cesium radioisotopes.

Effluents from the Tarapur (BWR reactor) power-plant contain iodine, cesium, and cobalt

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radioisotopes. Environmental monitoring is particularly useful for detecting an occasional large discharge made unwittingly. Research was conducted to optimize techniques for sampling and analysis. Trace element content was measured for several organisms (lobster, oyster, clam, crab, Bomby Duck, Singhal, and sea weed). Prawns and crabs are suitable indicators for Cs-137, and sea weed (for iodine and cobalt radioisotopes) and sea salt are versatile indicators. The high isotopic dilution of Sr-90 in sea water results in low sensitivity of indicators in this case. (See also W72-10946) (Bopp-ORNL)
W72-10958

APPLICATIONS OF RADIOPHYTOLOGY PRINCIPLES TO DESIGN OF AIR POLLUTION EFFECTS RESEARCH PROGRAMS, Environmental Protection Agency, Corvallis, Oreg.

D. S. Barth, and R. E. Engel.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 17 p, 1 fig, 17 ref.

Descriptors: *Air pollution, *Path of pollutants, *Pollution abatement, *Public health, Legal aspects, Federal jurisdiction, International commissions, Research priorities, Water pollution sources, Environmental effects, Radioecology, Lead, Toxicity, Lead radioisotopes, Gasoline, Particle size, Additives, Systems analysis, Monitoring, Water quality control, Technology.

Before setting National Air Quality Standards, effects of an air pollutant must be known as well as the sources and measurement and control technology. The example of lead pollutant shows that management of environmental resources requires a systems approach which considers all effects and interactions. Important branches of research include: early and late effects on man and animals; possible interaction of lead with other environmental chemicals; relative intake from the atmosphere, food, and beverages; biotransformation by lower organisms; monitoring of food and water; and factors that bear on dissipation of air pollutants. (See also W72-10946) (Bopp-ORNL)
W72-10959

THE EFFECTS OF SUBLETHAL AMOUNTS OF CADMIUM AND MERCURY ON THE METABOLISM OF ZINC-65 BY FRESHWATER FISH,

European Atomic Energy Community, Ispra (Italy), Joint Nuclear Research Center.

M. Merlini, F. Argentesi, A. Brazzelli, B.

Oregioni, and G. Pozzi.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 17 p, 1 fig, 6 tab, 12 ref.

Descriptors: *Zinc radioisotopes, *Absorption, *Retention, *Freshwater fish, Nuclear wastes, Path of pollutants, Food chains, Public health, Mercury, Cadmium, Radioactivity effects, Effluents, Laboratory tests.

Live fish, which were maintained in lake water containing 3 microCi/liter of Zn-65 as chloride, were counted at intervals. The initial data indicate that the time for equilibration with Zn-65 can be as long as 1.5 years. The excretion curve has 4 components. The effect of Cd is one of isotopic dilution. (See also W72-10946) (Bopp-ORNL)
W72-10960

RADIOLOGICAL INVESTIGATIONS IN THE GULF OF TARANTO, 1. GENERAL CIRCULATION IN THE GULF OF TARANTO AND DIFFUSION

FUSIN PROCESSES OFFCOAST THE TRISAIA CENTER,

Comitato Nazionale per l'Energia Nucleare, Rome (Italy), Laboratorio Radioattività Ambiente; and Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy); and Comitato Nazionale per l'Energia Nucleare, La Spezia (Italy), Laboratorio per lo Studio della Contaminazione Radioattiva del Mare.

P. Cagnetti, M. Bernhard, and A. Zattera.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 51 p, 15 fig, 1 tab, 13 ref.

Descriptors: *Nuclear powerplants, *Effluents, *Radioactivity, *Waste dilution, Systems analysis, Mixing, Europe, Radioecology, Path of pollutants, Eddies, Water circulation, Environmental effects, Simulation, Forecasting, Water pollution sources, Mathematical models.

Identifiers: Gulf of Taranto.

Dilution of the Trisaia nuclear powerplant effluent was estimated from data collected during 1968-1971. A radioisotope release of 1 Ci/year at the outfall gives with the initial pipeline which will extend about 200 m from the shore 3.4 nanoCi/cubic m at the shore; for a 2 km pipeline, 56 picoCi/cubic m. In order to consider the effect of an eddy which may exist at certain periods in the outfall region, a compartmental model was used with a 10 km diameter eddy. The order of magnitude of the dilution was unchanged by the eddy. (See also W72-10946 and W72-10962) (Bopp-ORNL)
W72-10961

RADIOECOLOGICAL INVESTIGATIONS IN THE GULF OF TARANTO, 2. PRELIMINARY ESTIMATION OF THE RECEIPTIVITY FOR LOW LEVEL RADIOACTIVE WASTES OF THE SITE IN THE GULF OF TARANTO,

Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

M. Bernhard, P. Cagnetti, A. Nassogne, C. Peroni, and P. Piro.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 32 p, 3 fig, 11 tab, 14 ref.

Descriptors: *Nuclear wastes, *Food chains, *Environmental effects, Fish, Estuarine environment, Europe, Path of pollutants, Public health, Feasibility studies, Systems analysis, Radioecology, Monitoring, Effluents, Radioisotopes, Absorption, Human population.

Identifiers: Gulf of Taranto.

Effluent released by the Trisaia nuclear center to the Gulf of Taranto and environmental uptake of radionuclides will be monitored. The maximum permissible concentrations of radionuclides were calculated, using both 'Specific Activity' and 'Concentration Factor' approaches except when data for the former were lacking. Although further study will probably show that this outfall has higher capacity, it is recommended that at present the effluent activity should not exceed 22 times that now proposed. External exposure to 'beach fishermen' and internal exposure to trawler crews are the limiting population factors. Most fish caught in the area are distributed at the large Taranto market. (See also W72-10946 and W72-10961) (Bopp-ORNL)
W72-10962

RADIOECOLOGICAL ANALYSIS OF THE UPPER DANUBE, (RADIOOKOLOGISCHE ANALYSE DER OBEREN DONAU),

Bayerische Biologische Versuchsanstalt, Munich (West Germany).

M. Ruf.

Presented at the Commission of the European Communities International Symposium,

Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 29 p, 11 tab, 13 ref.

Descriptors: *Nuclear wastes, *Rivers, *Public health, *Europe, Radioecology, Systems analysis, Path of pollutants, Nuclear powerplants, Radioisotopes, Radioactivity effects, Effluents, Food chains, Absorption, Fish potable water, Irrigation effects, Milk, Cattle, Forecasting, Water pollution effects, On-site investigations, Environmental effects.

The effluent from the Gundremmingen 237 MWe demonstration nuclear powerplant in Bavaria on the upper Danube River serves as an example of the future radionuclide load. The maximum of 30 of such installations expected by the year 2000 will not cause radiation doses exceeding the 30 mrem/year limit for gonads set by the German atomic commission, excepting for certain groups such as those with very high fish consumption. Doses (in mrem/year) calculated for a fission and corrosion product mixture totaling 3,030 picocCi/liter are: drinking water (1.3), consumption of 10 g fish/day (1.8), watering cattle-milk (0.1), irrigation-total food (3.0), maximum from external exposure for workers near the water (10). (See also W72-10946) (Bopp-ORNL)
W72-10963

UPTAKE THROUGH FOOD CHAINS OF RU, CO AND ZN RADIOISOTOPES FROM RADIOACTIVE EFFLUENTS RELEASED TO INLAND WATER (ETUDE DU TRANSFERT A L'HOMME, PAR SES ALIMENTS, DES RADIOISOTOPES DU RUTHÉNIUM, DU COBALTE ET DU ZINC REJETS DANS LES EAUX CONTINENTALES),

Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France), Centre d'Etudes Nucléaires; European Atomic Energy Community, Ispra (Italy), Joint Nuclear Research Center; Centre d'Etude de l'Energie Nucléaire, Mol (Belgium); and Société Ugine-Kuhlmann, Levallois (France). R. Bittel, M. Merlini, H. Beque, A. Berg, and C. Myttenaere.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 19 p, 11 tab, 14 ref.

Descriptors: *Food chains, *Nuclear wastes, *Cobalt radioisotopes, *Zinc radioisotopes, Path of pollutants, Freshwater fish, Potable water, Radioecology, Rivers, Water pollution effects, Irrigation water, Systems analysis, Forecasting, Vegetable crops, Diets, Public health, Absorption, Cereal crops, Rice, On-site investigations.

Identifiers: *Ruthenium radioisotopes.

The hazard to man from Ru, Co, and Zn radioisotopes is estimated; and shortcomings of the available data and the method are shown. Most uptake of Ru is from drinking water; for certain diets, most uptake of Co and Zn is from vegetables irrigated by contaminated water or from consumption of fish from contaminated water. Particularly the case of Zn should be studied in more detail. (See also W72-10946) (Bopp-ORNL)
W72-10964

STUDY OF RADIOSTRONTIUM FIXATION AND DESORPTION BY ANGUILLA ANGUILLA (EEL) IN FRESH AND SALT WATER AND ITS TRANSFERENCE TO MAN IN FOOD, (ETUDE DE LA FIXATION ET DE LA DESORPTION DU RADIOSTRONTIUM PAR ANGUILLA ANGUILLA (L'EN EAU DOUCE ET EN EAU SALEEE ET DE SON TRANSFERT A L'HOMME PAR L'ALIMENTATION),

Commissariat à l'Energie Atomique, Cadarache (France), Centre d'Etudes Nucléaires.

L. Foulquier, G. Marcoux, and A. Grauby.

Presented at the Commission of the European Communities International Symposium,

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Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 34 p, 8 fig, 8 tab, 24 ref. English summary.

Descriptors: *Strontium radioisotopes, *Food chains, *Eels, *Absorption, Public health, Europe, Radioecology, Nuclear wastes, Path of pollutants, Water pollution effects, Freshwater, Saline water, On-site investigations, Laboratories, Retention.

In the Rhone delta, a natural outlet for all forms of pollution, intensive industrial eel fishing takes place, mainly for export. Initially about 0.5% of the Sr intake of the eel was retained, but equilibration occurred after about ten weeks. Similar results were obtained for fresh and saline waters. The edible parts contained about 20% of the total Sr. Consumption of 100 g/day would give a Sr intake of about 0.2 pCi/day, an almost negligible amount in comparison to the intake from drinking water having the same Sr content as the water in which the eels resided. (See also W72-10946) (Bopp-ORNL) W72-10965

UPTAKE INTO MAN'S FOOD CHAIN OF RADIUM 226 ORIGINATING FROM INDUSTRIAL EFFLUENTS RELEASED INTO RIVERS, (TRANSFERT DANS LA CHAINE ALIMENTAIRE DE L'HOMME, DU RADIUM 226 PROVENANT D'EFFLUENTS INDUSTRIELS DEVERSES DANS DES COURS D'EAU),

Centre d'Etude de l'Energie Nucleaire, Mol (Belgium); Institut d'Hygiene et d'Epidemiologie, Brussels (Belgium); and Controle Radioprotection, Brussels (Belgium).

R. Kirchmann, A. Lafontaine, G. Cantillon, and R. Boulenger.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 16 p, 1 fig, 1 tab, 3 ref.

Descriptors: *Radium radioisotopes, *Public health, *Rivers, *Water pollution effects, Effluents, Path of pollutants, Sediments, Suspended solids, Sediment transport, Food chains, Milk, Pastures, Vegetable crops, Radioecology, Nuclear wastes, Potable water, Filtration, Systems analysis, Land reclamation, Arable land.

Identifiers: Belgium.

A survey was made of contamination of river water and soil by waste from a uranium-radium factory near the CEN laboratory at Mol, Belgium, including deposition and solution of organic and inorganic sediments. A gamma scintillation detector in a helicopter was used to locate contaminated soil. Radium in river water was predominantly in the form of suspended particles. Radium in sediment was largely confined to a shallow surface layer. Flooding of tailings constituted a greater local hazard than the river sediment. Consumption of vegetables grown in the region would give only about 1.4 times the maximum-recommended-value radiation dose. Milk from cows would contain from 6-15 times more radium than usual, a value sufficient that monitoring the radioactivity of such milk is recommended. (See also W72-10946) (Bopp-ORNL) W72-10966

BEHAVIOR IN RIVERS OF RADIOCOBALT AND RADIONGANANESE IN EFFLUENTS FROM PWR NUCLEAR POWERPLANTS, (COMPORTEMENT, EN RIVIERE, DES RADIOCOBALTS ET DU RADIONGANANESE PROVENANT D'EFFLUENTS D'UNE CENTRALE PWR),

Centre d'Etude de l'Energie Nucleaire, Mol (Belgium); and Institut d'Hygiene et d'Epidemiologie, Brussels (Belgium).

R. Kirchmann, and G. Cantillon.

Presented at the Commission of the European Communities International Symposium,

Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 17 p, 8 tab, 2 ref.

Descriptors: *Nuclear wastes, *Radioactivity effects, *Cobalt radioisotopes, *Tritium, Absorption, Sediments, Europe, Path of Pollutants, On-site investigations, Aquatic plants, Water analysis, Laboratory tests, Effluents.

Identifiers: Manganese radioisotopes, Pressurized water reactors.

During periods of effluent release from the Ardennes nuclear powerplant, downstream effects were studied. Tritiated water concentration in river water reached about 1500 picoCuries/liter; Co and Mn radionuclides, about 10 picoCuries/liter. Field and laboratory studies gave fixation of Mn and Co by sediments of from 0.7 to 2%. Co and Mn concentration factors for sediment (in suspension) were as high as about 30,000; for a species of aquatic moss, about 600. (See also W72-10946) (Bopp-ORNL) W72-10967

PHYSIOLOGICAL EFFECT OF SUBLETHAL DOSES OF METALLIC POLLUTANTS AND DETERGENTS ON FISH IN SOFT WATER: MODIFICATION OF CALCIUM EXCHANGE, (EFFET PHYSIOLOGIQUE DE DOSES SUBLÉTALES DE POLLUANTS MÉTALLIQUES ET DE DETERGENTS SUR LE POISSON D'EAU DOUCE: MODIFICATION DU TAUX D'EXCHANGE DE CALCIUM À PARTIR DE L'EAU),

European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Centre.

A. Berg, and N. Verheyden.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 11 p, 1 fig, 2 tab, 11 ref.

Descriptors: *Water pollution effects, *Zinc, *Alkylbenzene sulfonates, *Freshwater fish, Tracers, Strontium radioisotopes, Fish physiology, Calcium, Absorption, Hardness (Water), Radioecology, Analytical techniques, Radioactivity effects, Isotope studies.

The use of Sr-85 as a tracer to follow the Ca metabolism of fish was demonstrated. Redfish (*Carassius auratus* L.) and sunperch (*Lepomis gibbosus* L.) were exposed from 9-15 days to sublethal concentrations of pollutants (0.5 ppm Zn, 0.05 ppm Hg, and 2.5 ppm alkylbenzene sulfonate, respectively) in water having low or normal hardness (4-10 or 20 ppm Ca). Although the behavior of the fish and their rate of food consumption were normal, the exchange rate of Ca from water was lowered (as much as 50% of the normal value) as a result of inhibition of absorption through the gills. In some instances a gradual acclimation to the pollutants was observed. (See also W72-10946) (Bopp-ORNL) W72-10968

UPTAKE OF CS-137 AND CO-60 BY MARINE FISH (PLEURONECTES PLATESSA L., CALLIONYMUS LYRA L., AND TRACHINUS VIPERA CUV.), (OBSERVATIONS SUR LA CONTAMINATION EXPÉRIMENTALE DE TROIS ES PECHES DE POISSONS MARINS PLEURONECTES PLATESSA L., CALLIONYMUS LYRA L., ET TRACHINUS VIPERA CUV., PAR LE CAESIUM 137 ET LE COBALT 60),

Commissariat à l'Energie Atomique, Cherbourg (France). Centre de la Hague.

A. Fraizer, and J. Ancelin.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 28 p, 8 fig, 8 tab, 23 ref.

Descriptors: *Marine fish, *Cobalt radioisotopes, *Food chains, *Nuclear wastes, Path of pollutants, Radioecology, Fish physiology, Absorption, Bottom fish, Bottom sediments, Physicochemical properties, Ion exchange, Analytical techniques.

Identifiers: Cesium radioisotopes.

When fish were placed in contaminated sea water in an aquarium, radionuclide uptake had not reached equilibrium at the end of the 2 month experiment. Analysis by ion exchange showed that the cationic form of the Cs-137 was retained, but that nearly half of the initially cationic Co-60 was changed to insoluble, anionic, or neutral forms. An attempt to determine the effect of the presence of sediment was difficult to interpret since absorption by sediment reduced the concentration of radionuclide in the water to a relatively low value. The concentration factor for uptake by the whole fish was 4-5 for Cs-137 and 2-3 for Co-60. Concentration factors of various organs for Cs-137 were as high as 10 (heart, digestion tube, and liver), and 6 for Co-60 (the liver). (See also W72-10946) (Bopp-ORNL) W72-10969

IMPORTANCE OF RADIOECOLOGICAL RESEARCH FOR METALLIC AND ORGANO-METALLIC POLLUTANTS, (UTILISATION DES INFORMATIONS DES RECHERCHES RADIOECOLOGIQUES RELATIVES AUX PRODUITS MÉTALLIQUES D'ACTIVATION POUR L'ÉTUDE DES TRANSFERTS À L'HOMME DE POLLUANTS CHIMIQUES MÉTALLIQUES OU ORGANO-MÉTALLIQUES),

Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires. R. Bittel.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 12 p, 1 tab, 19 ref.

Descriptors: *Radioecology, *Nuclear wastes, *Path of pollutants, *Heavy metals, Food chains, Rice, Tracers, Water pollution effects, Cobalt radioisotopes, Zinc radioisotopes, Mercury, Lead, Lead radioisotopes, Irrigation water, Aquatic plants, Bioindicators, Absorption, Suspension, Freshwater fish, Aquatic animals.

Radioisotopic tracers (listed for 11 common metallic pollutants) are useful in research on heavy metal pollution (including lead and mercury pollutants). Studies on nuclear-waste pollution have shown effects of general interest: seasonal variation in the uptake of zinc by aquatic plants, uptake of cobalt by aquatic organisms through sorption of suspended particles, a lesser uptake by aquatic organisms for complexed (anionic) cobalt and chromium as compared with simple cations. (Thus bioindicators may be used to indicate the physicochemical state.), cobalt uptake by rice plants was largely through irrigation water, and cobalt uptake by freshwater fish was more from the water than through the food chain. (See also W72-10946) (Bopp-ORNL) W72-10970

MODELLING THE RELEASE OF EFFLUENTS TO SURFACE WATERS, (CONTRIBUTION D'UN MODÈLE PRÉVISIONNEL À L'ÉTABLISSEMENT DE FORMULES DE REJET D'EFFLUENTS RADIOACTIFS DANS LES EAUX),

Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires. R. Bittel.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 10 p, 11 ref.

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Descriptors: *Mathematical models, *Planning, *Discharge (Water), *Waste water disposal, Methodology, Radioecology, Nuclear wastes, Pollution abatement, Chemical wastes, Path of pollutants, Absorption, Radioisotopes, Estuaries, Rivers, Mixing, Waste dilution, Diets, Systems analysis.

A rapid, approximate method is suitable for calculating a limiting rate of release of radioisotope carrying effluent. The internal radioisotope dose to the population is expressed in terms of the diet, the transfer coefficient from water to food, and the contamination level of the water (irrigating, drinking, or seafood-related waters according to the case). Assuming a constant rate of radioactivity release, formulas are given which relate it to mixing parameters of rivers and estuaries. Application of a similar method to the case of chemical pollutants is discussed briefly. (See also W72-10946) (Bopp-ORNL) W72-10971

RADIOECOLOGY IN CHEMICAL POLLUTION STUDIES, (LES RENSEIGNEMENTS DE LA RADIOECOLOGIE DANS LE DOMAINE DE LA POLLUTION CHIMIQUE DU MILIEU), Faculty of Sciences, Naples Univ. (Italy).

A. Paoletti.

Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 20 p, 7 fig, 69 ref.

Descriptors: *Radioisotopes, *Aquatic life, *Reviews, *Chemical wastes, Water pollution effects, Path of pollutants, Absorption, Flocculation, Waste water treatment, Water treatment, Radioecology, Aquatic microorganisms, Food chains, Pesticides, Heavy metals.

The widespread distribution of pollutants (dust, pesticides, talc, Hg, Pb, As, polychlorinated biphenyls, benzopyrene); their biological uptake; and radioisotope pollution are reviewed briefly. Studies of radionuclide uptake by algae are covered in more detail. Fate of pollutants in water treatment and sewage treatment plants is discussed briefly. Algae and bacteria provide natural flocculants and absorbents for many pollutants, but also constitute the beginning of the aquatic food chain which may concentrate certain pollutants by processes currently being studied. (See also W72-10946) (Bopp-ORNL) W72-10972

EFFECT OF THE QUALITY OF THE WATER ON THE TRANSPORT OF SR AND CS RADIOISOTOPES IN RICE IRRIGATION, (INFLUENCE DE LA QUALITE DE L'EAU D'IRRIGATION SUR LE TRANSFERT DU RADIOCESIUM ET DU RADIOSTRONTIUM EN RIZIERE IRRIGUEE),

European Atomic Energy Community, Ispra (Italy).

C. Myttenaere, and J. Mousny. Presented at the Commission of the European Communities International Symposium, Radioecology Applied to the Protection of Man and His Environment, Rome, Sept. 1971. 18 p, 7 tab, 14 ref.

Descriptors: Strontium radioisotopes, Irrigation water, *Rice, *Water pollution effects, Cereal crops, Radioecology, Europe, Path of pollutants, Nuclear wastes, On-site investigations, Absorption, Food chains, Public health, Stable isotopes, Plant physiology, Nutrients, Irrigation effects, Fertilization.

Identifiers: Cesium radioisotopes.

The types of irrigation water used were (1) demineralized, (2) from Lake Majeur (20 ppm Ca, 1.5 ppm K, 0.2 ppm Sr) and (3) from Lake Majeur enriched by the addition of nitrates (100 ppm Ca, 5 ppm K, 1 ppm Sr). For rice plants grown in

radioisotope-containing soil, irrigation by the three water types, respectively, gave Sr-85 uptake in the ratio 1/1/0.5; Cs-134 uptake in the ratio 1/2/0.6. The percentages of the uptake by the whole plant which occurred in the stem were 27.9/5.9/5.2 for Sr-85 and 14.7/3.0/3.5 for Cs-134; in the caryopsis, 1.8/1.2/5.1 for Sr-85 and 11.5/19.2/12.4 for Cs-134. The relatively high uptake by the caryopsis in the case of the Lake Majeur water may involve retention by soil and the stem, activity of ions in water, or other mineral nutrition factors suggested by earlier work. Differences in specific activity which were found between different parts of the plant may result from differences in assimilation of stable isotope from the soil by the deep roots as compared with assimilation of the radioisotope from the water by the shallow roots and the stem. Data are also presented on radioisotope uptake by the irrigation water, and on Mn and Fe uptake by the plants. (See also W72-10946) (Bopp-ORNL) W72-10973

GENEVA 1971. DEVELOPMENT OF ATOMIC ENERGY AND THE ENVIRONMENT, (LE DEVELOPPEMENT DE L'ENERGIE ATOMIQUE ET L'ENVIRONNEMENT), M. Caron.

Energie Nucleaire, Vol. 13, No. 6 p 421-427, Nov.-Dec. 1971. 1 fig, 4 tab, 27 ref.

Descriptors: *Nuclear wastes, *Path of pollutants, *Ecosystems, Water pollution effects, Safety, Systems analysis, Radioactive waste disposal, Effluents, Waste water treatment, Fallout, Reviews, Nuclear powerplants.

Dissolution of gas and entrainment of dust by water and rain produces river pollution by natural radioisotopes (K, Ra, U, and others) and by wastes from nuclear installations (which vary with reactor type). The adequacy of standards for effluents is demonstrated, taking into account complexities of the aquatic ecosystem. Effluent treatment to remove radionuclides for storage in solid form in geologic formations, and precautions to avoid serious reactor accidents are discussed. (Bopp-ORNL) W72-10974

PROJECT RULISON - FINAL OPERATIONAL RADIOACTIVITY REPORT - PRODUCTION TESTS,

Nevada Operations Office (AEC), Las Vegas.

R. L. Gotchy.

Available from NTIS, Springfield, Va., as NVO-112, \$3.00 in paper copy, \$0.95 microfiche. Report No. NVO-112, Feb. 1972. 71 p.

Descriptors: *Nuclear explosions, *Testing, *Assay, *Evaluation, *Research facilities, *Air pollution, *Water pollution, Water pollution sources, Measurement, Tritium, Krypton, Carbon, Mercury, radioactivity, Secondary recovery (Oil), Natural gas, Cost-benefit analysis, Public benefits. Identifiers: Project Rulison, Peaceful applications, Concentration.

A summary is presented of most of the significant radiological surveillance data generated during the Production Tests of Project Rulison, a nuclear gas stimulation experiment, detonated September 10, 1969, in Northwestern Colorado. Data are included on the radiochemical and chemical quality of the Rulison gas during the tests and estimates of the quantities of 3H, 85Kr, 14C and 203Hg released to the atmosphere as a result of the tests. Detail data are given for the first, second and third production tests. (Houser-ORNL) W72-10981

ENVIRONMENTAL MONITORING IN THE VICINITY OF THE LOS ALAMOS SCIENTIFIC LABORATORY, JANUARY THROUGH JUNE, 1971.

Los Alamos Scientific Lab., N. Mex.

For primary bibliographic entry see Field 05A. W72-10982

FORMS OF PHOSPHORUS IN A SEQUENCE OF SOILS DEVELOPED ON FRASER RIVER ALUVIUM,

Department of Agriculture, Agassiz (British Columbia) Research Station.

M. K. John, and E. H. Gardner.

Can J Soil Sci. Vol 51, No 3, p 363-369. 1971.

Identifiers: Aluvium, Forms, Fraser River, *Phosphorus, Particle size, *Soil properties, Soil profiles.

The values for inorganic P when apportioned as Al-P, Fe-P, reductant-P and Ca-P were found to be dependent of soil-forming processes. Ca-P levels decreased and Fe-P and organic-P levels increased with increasing distance from the river, and with more pronounced profile development. Changes in the relative amounts of these various forms of soil P occurred over relatively short distances and affected the amounts of P extracted in standard soil testing methods. P levels depended very little on soil texture for the majority of the soils, although there was some evidence in favor of fine particle sizes over the sand fractions as a source of P in 1 profile.--Copyright 1972, Biological Abstracts, Inc. W72-10994

POND-TROUT AS CARRIERS OF CLOSTRIDIUM BOTULINUM AND CAUSE OF BOTULISM: I. CLOSTRIDIUM BOTULINUM TYPE E AND FISH-BOTULISM,

Tieraerzlichen Hochschule, Hanover (West Germany). Institut Tieraerzliche Lebensmittelkunde Fleischhygiene.

For primary bibliographic entry see Field 05C. W72-10995

POND TROUT AS CARRIERS OF CLOSTRIDIUM BOTULINUM AND CAUSE OF BOTULISM:

4. SOURCES OF CONTAMINATION AND PATHS OF CONTAMINATION IN FISHERIES AND PREPARATION INDUSTRY, POSSIBILITIES OF IMPROVING HYGIENE, Tieraerzlichen Hochschule, Hanover (West Germany). Institut Tieraerzliche Lebensmittelkunde Fleischhygiene.

For primary bibliographic entry see Field 05C. W72-10997

EFFECT OF EXCESS MOISTURE ON CERTAIN PROPERTIES OF SOD PODZOLIC SOIL,

I. P. Grechin.

Dokl Mosk S-Kh Akad Im K A Timiryazev. Vol 154, p 55-59. 1969.

Identifiers: *Excess water (Soils), Flow, Moisture, Phosphates, Podzols, Redox, Sod, *Soil properties, Stagnant water.

The effect of flowing (with >8 mg/l of dissolved O₂) and stagnant (with only traces of dissolved O₂) waters on soil properties was studied. The experiment was conducted for 28 days at 18-20 deg. C. Soil with flowing moisture had Eh (redox potential) 513 mV and 0.7 mg ferrous Fe (extracted by 0.1 N H₂SO₄)/100 g soil, while soil with stagnant moisture had 109 and 49.6, respectively. The soil with stagnant moisture had a higher content of phosphates but had no nitrates.--Copyright 1972, Biological Abstracts, Inc. W72-11001

GROUND-WATER CONTAMINATION-AN EXPLANATION OF ITS CAUSES AND EFFECTS.

Geraghty and Miller, Port Washington, N.Y.

Water Information Center, Inc. Port Washington, NY, (May 1972). 15 p, 5 fig, 1 tab, 33 ref.

Descriptors: *Water pollution sources, *Path of pollutants, *Groundwater, Water pollution control, Manganese, Aquifers, Water quality. Identifiers: *Groundwater pollution.

The causes of groundwater pollution are many. Practically all buried sewers and pipelines leak.

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Waste-storage lagoons or ponds are rarely lined, and because all earth materials are permeable to at least some degree, the downward seepage of the liquid wastes must go on. Once in the ground, the wastes are hidden from view, and move through the geologic formations until they enter groundwater systems. While natural processes such as filtration and dilution can in some cases help to reduce the seriousness of groundwater pollution, many wastes remain essentially unchanged in composition after they enter a groundwater body, and travel through the earth until they either enter someone's water well or are discharged into a stream or river. A brief summary of the subject is provided in order to acquaint decision-makers, especially in industry and government, with the principal factors involved in groundwater contamination and with the general state of knowledge concerning how and where it is taking place. (Woodard-USGS)
W72-11072

THE MICROBIOLOGY OF TERRESTRIAL CRUDE OIL DEGRADATION,
Cold Regions Research and Engineering Lab., Hanover, N.H.
P. G. Hunt.
Army Cold Regions Research and Engineering Laboratory Special Report 168, April 1972. 13 p, 8 fig, 29 ref. DA Task 4A061101A91D03.

Descriptors: *Water pollution sources, *Oil spills, *Degradation (Decomposition), *Microorganisms, *Cold regions, Land, Pipelines, Groundwater movement, Temperature, Microbiology, Alaska.
Identifiers: Microbial inoculations.

Because of the long generation times of microbes in cold environments, oil spills in cold terrestrial areas may be one of the few places where microbial inoculation may be beneficial. Microorganisms capable of decomposing crude oil are common in terrestrial areas around the world. The straight-chained hydrocarbons of C10 to C18 length, the kerosene fraction, are the most susceptible to microbial degradation. The shorter-chained hydrocarbons, the gasoline fraction, are degraded more slowly, and in some instances may be toxic to microorganisms. Some organisms, the psychrophiles, grow best at temperatures between 0 and 20°C. In a cold environment such as Alaska, the natural recovery of a terrestrial oil spill will be slow and may take more than 15 to 20 years, but it is quite likely to result in the least total environmental damage. (Woodard-USGS)
W72-11077

MERCURY IN WATERS OF THE UNITED STATES,
Geological Survey, Menlo Park, Calif.
E. A. Jenne.
Geological Survey Open-file Report, April 1, 1972. 34 p, 6 fig, 1 tab, 20 ref.

Descriptors: *Water pollution sources, *Mercury, *Chemical analysis, *Data collections, *United States, Surveys, Sampling, Surface waters, Groundwater, Sediments, Natural streams, Waste water (Pollution), Reservoirs, Lakes, Aquifers, Rivers, Industrial water, Frequency analysis.

The Department of the Interior carried out a nationwide reconnaissance of mercury in United States water in the summer and fall of 1970. Thirty percent of the samples from the industrial waste water category contained greater than 10 micrograms per liter of mercury. Nearly 5% of the samples of this group contained more than 1,000 micrograms per liter. Only 4% of the surface-water samples contained in excess of 10 micrograms per liter. The higher mercury concentrations were generally found in small streams. About half of the 43 samples from the Mississippi River contained less than 0.1 micrograms per liter. The mercury content of lakes and reservoirs scatter between less than 0.1 and 1.8 micrograms per liter. With few exceptions, the mercury content of ground-

water samples was below detection. The natural background of surface and groundwater is probably below 0.1 micrograms per liter of mercury. Thus, future analyses with detection limit of at least 0.01 micrograms per liter will be required to obtain useful information on the background levels of mercury in natural waters. Below mercury mining, the mercury content of the suspended sediment may reach 500 micrograms per kilogram. (Woodard-USGS)
W72-11078

5C. Effects of Pollution

DDT IN SURFACE WATERS, (IN GERMAN),
Hygiene-Institut, Schwerin (East Germany).
D. Wolter, and H. Rugestein.
Z Gesamte Hyg Grenzgeb. Vol 17 No 4 p 264-266. 1971. (English summary).
Identifiers: *DDT, Germany, Lakes, Pesticides, Residues, Surface waters, *Water pollution sources, Potable water.

The contamination of freshwater lakes with DDT due to the agricultural use of airplanes is reported. Investigations of surface waters in Schwerin country showed a DDT-content varying between <0.001 and 0.004 mg/l. The possible effects of the DDT-content on the human organism are shown. The question as to which are the scientifically founded tolerance values for drinking and bath water is raised.—Copyright 1972, Biological Abstracts, Inc.
W72-10460

THE EFFECT OF WATER TREATED WITH CHLORINE ON LIVING FISH,
Fovaros Allat-Novenykerje, Budapest (Hungary).

B. Penzes.
Allattani Kozel. Vol. 58, No. 1-4, p 87-89. 1971. Illus.
Identifiers: *Chlorine, Fish, *Fishkill, Water treatment.

Water with a Cl content of 0.15-0.4 mg/l kills native European freshwater fish. It destroys the respiratory wall epithelium of the gills. The construction of a dechlorination apparatus, its filter layers and capacity are discussed.—Copyright 1972, Biological Abstracts, Inc.
W72-10479

POWER PLANT SITING ON LAKE MICHIGAN,
Argonne National Lab., Ill.
For primary bibliographic entry see Field 06B.
W72-10492

POTENTIAL ENVIRONMENTAL MODIFICATION PRODUCED BY LARGE EVAPORATIVE COOLING TOWERS.
EG and G Inc., Boulder, Colo. Environmental Services Operation.

Copy available from GPO Sup Doc, \$0.75; microfiche from NTIS as PB-210 702, \$0.95. Environmental Protection Agency Water Pollution Control Research Series, January 1971. 75 p, 14 fig, 12 ref. EPA Program 16130 DHN 01/71.

Descriptors: *Cooling towers, *Weather modification, *Air pollution, Meteorology, Fog, Cloud physics, *Thermal pollution, Thermal powerplants, Evaporation, Mathematical models, Computer programs, Cloud seeding.
Identifiers: *Cooling tower plumes, Water vapor movement.

A readily usable model was developed for evaluating the extent of plumes from large evaporative cooling towers. Mathematical models were used to describe the dynamics of the wet cooling tower plume and its interaction with the environment. Primary emphasis was placed on predicting the height of the plume. Classical atmosphere diffu-

sion theory was used to determine the downwind spread. The saturation deficit of the atmosphere controls the downwind spread of and fogging caused by the plume. Except for cases where the relative humidity approaches 100%, downwind propagation is limited to periods when the air temperature falls below the freezing point. With given atmospheric conditions, increases in the tower radius, the saturation temperature, and the initial vertical velocity of the plume increase the plume height. A map of the U.S. indicating locations of potential adverse atmospheric effects due to cooling towers can be used in conjunction with local data. The appendix contains a description of the computer program, including input specifications. (Eagle-Vanderbilt)
W72-10548

ABUNDANCE AND DISTRIBUTION OF YOUNG ATLANTIC MENHADEN, BREVOORTIA TYRANNUS, IN THE WHITE OAK RIVER ESTUARY, NORTH CAROLINA,
National Marine Fisheries Service, Beaufort, N.C. Center for Estuarine and Menhaden Research.

E. P. H. Wilkins, and R. M. Lewis.
Fishery Bulletin, Vol 69, No 4, p 783-789, (1971). 4 fig, 2 tab, 15 ref.

Descriptors: *Atlantic menhaden, *Distribution, Salinity, Temperature, Tides, Turbidity, Larvae, Estuaries, Sampling, Fish populations, *North Carolina.

Identifiers: *White Oak River estuary, Illumination.

The effect of salinity, temperature, tide, turbidity and illumination on the distribution of larval, prejuvenile, and juvenile menhaden in White Oak River estuary was investigated. Most menhaden larvae entered the estuary in March after the water had warmed to about 10°C, and moved upstream to the low-salinity-freshwater zone where they transformed into juveniles. Laboratory tests from other studies showed that menhaden died when the water temperature fell below 4°C and rose above 33°C. More larvae were caught in the lower estuary on flood tide. After transformation to juveniles they were caught in schools throughout the estuary. Turbidity and illumination did not affect the distribution of menhaden, but illumination affected catchability, since more menhaden were collected during night tows. (Upadhyaya-Vanderbilt)
W72-10549

ANALYSIS OF THE EFFECT OF POTENTIAL REACTOR COOLING PONDS ON THE HANFORD GROUNDWATER SYSTEM,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.

D. B. Gearlock, R. D. Mudd, and A. E. Reisenauer. Available from the National Technical Information Service as BNWL-1507, \$3.00 in paper copy, \$0.95 in microfiche. BNWL-1507, September 1970. 16 p, 11 fig.

Descriptors: *Nuclear powerplants, *Groundwater, Mathematical models, Hydrological aspects, Seepage, Permeability.
Identifiers: *Hanford reactor, *Cooling ponds, Piezometric surface.

The hydrological effects of the three hypothetical unlined cooling ponds on the Hanford groundwater system are analyzed. Emphasis is on the effects in the region of the chemical processing plants in the 200 East and 200 West areas. The variable thickness transient model was reduced to steady state conditions to quickly investigate the hydrological influence. The piezometric surface beneath the 200-East Area would rise less than 5 feet with all ponds operating simultaneously and less than 3 feet with any one of the ponds operating independently. The 200-West Area would experience a rise in the piezometric surface of less than 1 foot with either the 420 foot pond or the 440 foot pond operating independently. With the 460

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foot pond operating independently or all three ponds operating simultaneously, the piezometric surface in the 200 West Area may rise as much as 25 feet. The results are preliminary and should not be used to judge the feasibility of the reactor cooling pond concept. (Upadhyaya-Vanderbilt) W72-10552

DEVELOPMENTAL RATES AT VARIOUS TEMPERATURES OF EMBRYOS OF THE NORTHERN LOBSTER (HOMARUS AMERICANUS MILNE-EDWARDS),
National Marine Fisheries Service, West Boothbay Harbor, Maine. Boothbay Harbor Lab. H. C. Perkins.
Fishery Bulletin, Vol 70, No 1, p 95-99, 1972. 3 fig, 2 tab, 3 ref.

Descriptors: *Growth rates, *Water temperature, *Lobsters, Age, Temperature, Crustaceans, Aquiculture, Embryonic growth stage, Maine, Thermal pollution.

Identifiers: Growth index.

The rates of development, time from extrusion to hatching at various temperatures, and differential developmental rates at the same temperature of lobster embryos are presented. The eyes of the embryos were measured to determine an index for the rates and degree of embryo development. The developmental rates of lobster embryos appear to be governed not only by their thermal environment but by the age or extent of development at which they are subjected to that temperature. Of seven egg masses held at 22.6 C, the embryos of least development at the start had a faster development rate at comparable levels of development than the more advanced embryos. Eggs at a higher temperature in the range 8-24 C take a shorter time from extrusion to hatching and from onset of eye pigment in the embryos to hatching than those at a lower temperature. The developmental rate of lobster embryos may be manipulated by adjusting the water temperature of holding tanks to insure periodic hatches of larvae throughout the year. (Eagle-Vanderbilt)

W72-10554

THE SANITARY SIGNIFICANCE OF ESCHERICHIA COLI IN VARIOUS CONDITIONS OF WATER DECONTAMINATION WITH RESPECT TO ENTEROVIRUSES, (IN RUSSIAN),
S. N. Cherkinskii, E. L. Lovtsevich, and V. A.

Ryabchenko.

Gig Sanit. Vol 36 No 3 p 7-10. 1971. Illus. (English summary).

Identifiers: Contamination, *Enteroviruses, *E. coli, *Water treatment.

The sanitary significance of *E. coli* in relation to enteroviruses depends on the proportion in which these microorganisms are present in the water undergoing decontamination.—Copyright 1972, Biological Abstracts, Inc.

W72-10560

CHRONIC EFFECTS OF CONSTANT ELEVATED TEMPERATURE ON THE FATHEAD MINNOW (PIMEPHALES PROMELAS RAFINESQUE),
Newton Fish Toxicology Lab., Cincinnati, Ohio. W. A. Brungs.

Transactions of the American Fisheries Society, Vol. 100, No. 4, p. 659-664, October 1971, 1 fig, 5 tab, 11 ref.

Descriptors: *Heated water, *Minnows, *Spawning, Fish reproduction, Lethal limit, Laboratory tests, Growth rates, Temperature, *Thermal pollution.

Identifiers: Chronic exposure.

A continuous, 12-month exposure of fathead minnows to elevated water temperature (26-34 C) showed that reproduction was more sensitive than

survival, growth, or egg hatchability in assessing the effect of temperature. The number of eggs produced/female, the number of eggs/spawning, and the number of spawnings/female were each gradually reduced at successive temperatures above the control (23.5 C). No spawning or mortality occurred at 32 C which was the lowest temperature where growth was apparently reduced. Male secondary sexual characteristics were less developed at 30 C than at lower temperatures. Whenever the temperature fell below approximately 22 C, spawning was reduced. (Eagle-Vanderbilt)

W72-10561

FISHERIES, COOLING-WATER DISCHARGES AND SEWAGE AND INDUSTRIAL WASTES,
Water Pollution Research Lab., Stevenage (England).

J. S. Alabaster, J. H. N. Garland, and I. C. Hart.
In: Symposium on Freshwater Biology and Electric Power Generation, Part I, Central Electricity Research Laboratories, United Kingdom, April 22, 1971, p 3-8, 1 tab, 6 ref. RD/L/M312.

Descriptors: *Fishes, *Cooling water, *Thermal pollution, Sewage, Industrial wastes, Temperature, Toxicity, Salmon, Trout, Dissolved oxygen, Powerplants, Fishkill.

Identifiers: *River Trent, United Kingdom.

Detailed surveys have been carried out in the Willington-Shardlow reach of the River Trent which contains Willington Power Station. The upper part of this reach and another reach further upstream between Walton-on-Trent and Burton-on-Trent containing Drakelow Power Station have also been examined using data of water quality made available by the Trent River Authority. Potential dangers exist to fresh water fish from the lethal effects of sudden exposure to cooling water normally heated 6-9 C above ambient. It is also possible that fish living in the winter in heated water could be killed by sudden return to normal temperatures in the event of a power station coming off load. The risk of killing salmonid smolts and adults passing through estuaries receiving heated effluents appears to be small at present. The minimum summer temperature at which upstream migrant salmon might be arrested is likely to be no higher than 22.5 C. In parts of the River Trent where cooling towers are used, the net effect on water quality and on the status of the fishery appears to be beneficial. (Upadhyaya-Vanderbilt)

W72-10567

THE BIOLOGICAL ASSESSMENT OF THERMAL EFFECTS IN SOME BRITISH RIVERS,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.

T. E. Langford.
In: Symposium on Freshwater Biology and Electric Power Generation, Part I, Central Electricity Research Laboratories, United Kingdom, April 22, 1971, p 9-39, 5 fig, 16 tab, 25 ref.

Descriptors: *Thermal pollution, *Resistance, *Invertebrates, *Heated water, Water temperature, Powerplants, River flow, Biochemical oxygen demand, Ammonia, Outlets.

Identifiers: Cooling ponds.

Surveys of the invertebrate faunas of 12 rivers were made at sampling points upstream and downstream of 20 power stations. Data from 3 series of surveys, plus previously unpublished data, have been analysed in an attempt to assess changes in invertebrate faunas below power station cooling water discharges. These changes have been compared with those caused by natural variations and other polluting discharges. The good correlation between the BOD and ammonia concentrations and the number of families recorded in faster rivers was not evident in the slower, silted rivers. There was no apparent correlation between

the general composition of river faunas and maximum temperature, at least up to 32 C. Temperature increases downstream of various power stations ranged from 1-12 C but the effects were not readily detectable by the ordinary semi-quantitative invertebrate surveys used to assess the effects of other effluents. A provisional field 'Temperature Tolerance Table' for some invertebrates has been assembled and may act as a guide for future planning. A number of species, known to be intolerant of organic or inorganic pollution have been found to survive temperatures of 28-30 C in the field. Evidence so far suggests that short periods of temperature around 30-32 C do not have marked effects on the faunas of most rivers. Very polluted rivers may have even more tolerant faunas. (Upadhyaya-Vanderbilt)

W72-10568

WATER IN ELECTRICITY GENERATION,
Central Electricity Generating Board, London (England). Planning Dept.
F. B. Hawes.

In: symposium on Freshwater Biology and Electric Power Generation, Part I, Central Electricity Research Laboratories, United Kingdom, April 22, 1971, p 81-86, 1 tab, 6 ref.

Descriptors: Water resources, *Thermal powerplants, Fishkill, Dissolved oxygen, Temperature, Cooling water, Low flow, *Thermal pollution.

Cooling water requirements have been reduced from over 0.45 cum/KW-hr in 1900 to 0.12 cu m/KW-hr. The consumption of electricity has doubled every 10 years for the past 40 years. There is not enough water at times of low flow in any of the rivers in England and Wales to meet the requirements for direct cooling of a single 500 MW generator. A rise in temperature does not reduce the content of dissolved oxygen in a discharge. The process is probably too rapid for an equilibrium concentration of oxygen to be reached at the new raised temperature before the heated water cools again. The successive passages of the water through the towers not only aerated it but stripped it of carbon dioxide. This caused an alteration in pH and an increase in dissolved oxygen, which improve the conditions in which the oxidation of inorganic matter can take place. The most important single problem appears to be to bring biological information, measurements or data into the view of water management and planning. (Upadhyaya-Vanderbilt)

W72-10570

THE NITRATE HAZARD IN WELL WATER, WITH SPECIAL REFERENCE TO HOLT COUNTY, NEBRASKA,
Geological Survey, Lincoln, Nebr.

For primary bibliographic entry see Field 05B.

W72-10591

THE EFFECTS OF ARTIFICIAL AERATION ON LAKE ECOLOGY,
Michigan State Univ., East Lansing.
A. W. Fast.

Copy available from GPO Sup Doc. \$4.25; microfiche from NTIS as PB-210 704, \$0.95. Environmental Protection Agency, Water Pollution Control Research Series, December 1971. 470 p, 120 fig, 21 tab, 115 ref. EPA Program 16010 EXE 12/71.

Descriptors: *Aeration, *Methodology, *Lakes, Eutrophication, Hypolimnion, Winterkill, Thermal stratification, Oligotrophy, Destratification.

Identifiers: Hemlock Lane (Mich), Section Four Lake (Mich).

Two Michigan lakes, eutrophic Lake Hemlock and oligotrophic Section Four Lake, were artificially aerated by compressed air from mid-June to September 7, 1970. Only the hypolimnion of the eutrophic lake was aerated which resulted in in-

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creased oxygen concentration from 0.1 mg/l to over 10.0 mg/l while thermal stratification was maintained. Zooplankton, zoobenthos, and fish distributed throughout the lake after aeration. Midges emerged from the deepest point. Aeration apparently reduced nutrient anaerobic regeneration but increased nutrient regeneration through aerobic decomposition of profundal sediments. Artificial destratification of the oligotrophic lake greatly increased the minimum temperature budget. Zoobenthos and surface phytoplankton standing crops were reduced but destratification had little apparent effect on the biota. Midges emerged from greater depths during aeration but depth distribution of organisms, other than crayfish, was not greatly altered. Following the summer artificial destratification, the winter oxygen concentration in Section Four Lake was 0.1 to 2.0 mg/l greater at all depths than the previous year; snow and ice cover were less. Hemlock Lake showed much higher oxygen at all levels during winter. Oxygen concentration was not only increased by aeration but the BOD was lowered. No appreciable winterkill occurred and many trout overwintered without any known ill effects. (Auen-Wisconsin)
W72-10605

DISSOLVED AND PARTICULATE ORGANIC CARBON IN SOME COLORADO WATERS,

Colorado State Univ., Fort Collins. Dept. of Zoology.

E. B. Reed.

Copy available from GPO Sup Doc as EP2.10:16010 EQA 10/71, \$1.00; microfiche from NTIS as PB-210 705, \$0.95. Environmental Protection Agency, Water Pollution Control Research Series October 1971. 89 p, 19 fig, 28 tab, 20 ref. EPA Program 16010 EQA 10/71.

Descriptors: *Carbon, *Distribution, Colorado, Lakes, Reservoirs, Streams, Detritus, Spatial distribution, Eutrophication, Laboratory tests, On-site investigations.

Identifiers: Organic carbon, Dissolved carbon, Particulate carbon.

Instantaneous amounts of organic carbon, both particulate and dissolved, in a number of freshwaters ranging from unproductive tarns to moderately productive reservoirs were measured by acid-per sulfate digestion and infrared absorption. Organic carbon was designated as net seston carbon, filter seston carbon, or dissolved carbon based on filtering techniques. Concentrations of dissolved carbon ranged from about 1 to 11 g/cu m; filter seston amounts varied from about 0.2 to 1 g/cu m; the net fraction or organic carbon ranged from less than 0.1 to over 0.2 g/cu m. Repeated sampling showed amounts of organic carbon, either dissolved or particulate, fluctuated considerably over short periods of time; the dissolved fraction probably varying less than particulate forms. On incubation of all carbon fractions at room temperature in darkness for periods up to 90 days, concentrations of organic carbon varied erratically and unpredictably. Almost daily measurements in samples incubated over three week periods also revealed erratic changes, with no clear reduction in total organic carbon. Metabolic activities of heterotrophic bacteria (and algae) probably complicated interpretation of results. The data have descriptive value, although they cannot, at this time, be related satisfactorily to the general limnological knowledge. (Jones-Wisconsin)
W72-10606

THE CARBON DIOXIDE SYSTEM AND EUTROPHICATION,

WARF Inst., Inc., Madison, Wis.

S. D. Morton, P. H. Derse, and R. C. Sernau.

Copy available from GPO Sup Doc, \$0.75; microfiche from NTIS as PB-210 706, \$0.95. Environmental Protection Agency, Water Pollution Control Research Series November 1971. 72 p, 2 fig, 8 tab, 15 ref, append. EPA Program 16010 DXV 11/71.

Descriptors: *Nuisance algae, *Carbon dioxide, *Algal control, Cyanophyta, Carbon, Chlorella, Bicarbonates, Aeration, Limiting factors, Eutrophication.

Identifiers: *Atmospheric carbon, Microcystis, Anabaena.

To determine the feasibility of eutrophication control by controlling carbon, three major areas were studied: the steady state, in which the growth rates of algae at various constant, maintained dissolved carbon dioxide concentrations were determined; the non-equilibrium, where natural atmospheric replenishment was the sole carbon source; and algal growth with inorganic bicarbonate as the sole carbon source. In studying growth rates of Chlorella, Microcystis, and Anabaena with respect to carbon availability, it was found that algae can utilize dissolved concentrations of carbon dioxide much lower than those from atmospheric equilibria. Algal growth control by sweeping carbon dioxide out by aeration with air containing very low carbon dioxide concentrations is difficult because of atmospheric replenishment of carbon dioxide. Bicarbonate is at least 50% utilized at growth rates as high as 7 mg/l per day. Atmospheric replenishment of carbon dioxide, without any wind mixing, can sustain growth rates of 1.5-2 mg/l per day for depths of at least 1.7 meters. (Jones-Wisconsin)
W72-10607

NUTRIENT SOURCES FOR ALGAE AND THEIR CONTROL,

Wisconsin Univ., Madison. Water Resources Center.

G. P. Fitzgerald.

Copy available from GPO Sup Doc, \$1.00; microfiche from NTIS as PB-210 707, \$0.95. Environmental Protection Agency, Water Pollution Control Research Series August 1971. 77 p, 4 fig, 26 tab, 53 ref. EPA Program 16010 EHR 08/71.

Descriptors: *Analytical techniques, *Nutrients, *Algae, *Bioassay, Phosphorus compounds, Nitrogen compounds, Cycling nutrients, Essential nutrients, Lakes, Mud, Wisconsin, Aquatic weeds, Eutrophication.

Identifiers: *Nutrient sources, Acetylene reduction, Lake Mendota (Wis), Lake Monona (Wis).

Bioassays for nutrient availability were evaluated to define conditions and limits under which each method can give meaningful results. The biological availability of algal nutrients in a water sample and the algal response to changes in the growth-limiting nutrient were measured. Factors other than insolubility prevent the nitrogen or phosphorus of certain samples of aerobic lake muds from being readily available for algal growth; P-limited Spirogyra has been found growing through mud layers containing 0.1% total phosphorus. The facts, that live algae and aquatic weeds do not share their adequate or surplus nutrients with nutrient-limited algae and that lake muds do not provide readily available nitrogen or phosphorus, indicate that once lake waters are stripped of available nutrients by plant production, further plant production will depend upon nutrients from continuous sources, such as wastewater effluents. Phosphorus-starved cells of Anabaena rapidly increase their capacity to reduce acetylene to ethylene when they receive phosphorus. This response may be used as a bioassay for detecting available phosphorus in aquatic ecosystems. Sensitivity of the method compares favorably with conventional methods for measuring dissolved orthophosphate, and has the advantage that it measures available phosphorus. (Jones-Wisconsin)
W72-10608

PESTICIDE INPUTS AND LEVELS: MINNESOTA WATERS—LAKE SUPERIOR BASIN.

Minnesota Pollution Control Agency, Minneapolis.

Copy available from GPO Sup Doc, \$1.00; microfiche from NTIS as PB-210 708, \$0.95. En-

vironmental Protection Agency, Water Pollution Control Research Series June 1971. 108 p, 8 fig, 42 tab. EPA Program 16050 EYT 06/71.

Descriptors: *Pesticides, *Minnesota, *Lake Superior, *Watersheds (Basins), Water pollution sources, Bioassay, Sewage effluents, Runoff, Monitoring, Sampling, DDT, DDE, Rivers, Chlorinated hydrocarbon pesticides, Flow.

Identifiers: Duluth (Minn.).

Concern about pesticide accumulation in the Upper Great Lakes prompted studies along Lake Superior's North Shore to provide current information on pesticide levels and contamination. Water samples were analyzed from the Grand Marais, the Duluth Pumping Stations, and the Duluth sewage treatment plant. Clams were exposed for bioassay purposes in 22 streams because they are concentrators of toxic substances, including chlorinated hydrocarbons, and reveal DDT and related compounds present in amounts below detection by ordinary analytical procedures. Under normal flow conditions, very little insecticide contamination was being contributed to Lake Superior from the drainage basin. Highest values occurred in the Lester and Lower St. Louis Rivers and in sewage effluent; in October, following heavy runoff, p,p'-DDT reached concentrations of 20-21.8 ppb. Medians in all other streams were less than 0.01 ppb. p,p'-DDT was present in greater concentrations than its o,p'-DDT isomer or DDE. p,p'-DDT values exceeded the median in four streams only. Native clams from the St. Louis River, with a resident time of 5-11 years, had accumulated appreciable concentrations of p,p'-DDT ranging from 93 to 1630 ppb. It is recommended that the St. Louis River be monitored at reasonable intervals. (Jones-Wisconsin)
W72-10609

ACID MINE POLLUTION EFFECTS ON LAKE BIOLOGY,

Indiana Univ., Bloomington. Water Resources Research Center.

Ronald W. Smith, and David G. Frey.

Copy available from GPO Sup Doc, \$1.25; microfiche from NTIS as PB-210 709, \$0.95. Environmental Protection Agency, Water Pollution Control Research Series, December 1971. 131 p, 47 fig, 18 tab, 100 ref, 2 append. EPA Program 18050 EEC 12/71.

Descriptors: *Strip mine lakes, *Acid mine water, Water pollution effects, *Lakes, *Indiana, Strip mines, Hydrogen ion concentration, Stratification, Meromixis, Management, Physicochemical properties, Sport fishing, Reclamation, Recreation, Succession, Biota, Acidic water, Ecosystems, Evolution.

For greater recreational potential of stripmine lakes, certain fundamental limnological information and the unique water chemistry resulting from leaching of substances contained in the cast overburden of the lakes were investigated. The six coal stripmine lakes studied during July 1969 to December 1970 in southern Indiana had a pH range of 2.5 to 8.2. Successional trends with increasing pH indicated lake differences. Increasing levels of dissolved oxygen and decreasing concentrations of dissolved substances showed environmental trends in surface waters. These tendencies were somewhat obscured by differences in the annual cycles of stratification, four of the lakes proving to be unexpectedly meromictic. Biological changes associated with increasing pH included increasing diversity and increasing homeostasis. Both pH and circulation patterns (meromixis vs. holomixis) influenced biomass, and bottom fauna was further limited by the steep-sided basin form. All stripmine lakes had much higher solute concentrations and lower biological diversity than a small local non-stripmine reservoir studied as control. A fertilization program in one lake has apparently eliminated all rooted aquatic plants, produced violent plankton oscillations, and low fish populations. Sport fishing in stripmine lakes

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could be improved by management techniques.
(Jones-Wisconsin)
W72-10610

EUTROPHICATION IN COASTAL WATERS: NITROGEN AS A CONTROLLING FACTOR.

California Univ., San Diego, La Jolla. Inst. of
Marine Resources.

Copy available from GPO Sup Doc, \$0.70;
microfiche from NTIS as PB-210 710, \$0.95. Environmental Protection Agency, Water Pollution Control Research Series, December 1971. 67 p, 12 fig, 14 tab, 51 ref. EPA Program 16010 EHC 12/71.

Descriptors: *Eutrophication, *Sea water,
*Coasts, *Nitrogen, *Phytoplankton, Water pollution effects, Nutrients, California, Sewage effluents, Marine biology, Primary productivity, Ammonia, Ureas, Absorption, Laboratory tests.

Identifiers: *Limiting nutrients, *Sewage outfalls, Diel periodicity.

The Southern California coastal sewage outfalls were investigated in relation to their effect upon standing stocks of phytoplankton, and on primary production, during two cruises in July 1970 and June 1971. Kinetic parameters for the assimilation of ammonium, nitrate, and urea were determined at the outfall sites using N-15 labeled substrates. Laboratory studies investigated the utilization of various forms of nitrogen by phytoplankton, mechanisms and rates of nitrogen assimilation, and enzymes of nitrogen assimilation. Ammonium and nitrate assimilation were found to vary from day to night as does the capacity for photosynthesis in cultures were grown on light-dark cycles simulating natural illumination. In fitting data on rates of nitrogen assimilation vs. concentrations of nitrogen to the Michaelis-Menten equation, modified to describe nutrient uptake, it was found that the maximum growth rate was a variable, while the saturation constant was uniform over a range of dilution rates of N-limited chemostat cultures. The chemical composition of phytoplankton, particularly ratios of carbon/chlorophyll and carbon/nitrogen, varied with dilution rate in reproducible ways. By varying the dilution rate of such cultures one seems to regulate the degree of nitrogen-deficiency of the phytoplankton. (Jones-Wisconsin)

W72-10611

BOTTOM FAUNA IN THE TRESNA DAM RESERVOIR IN 1966.

Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
E. Krzyzanek.

Acta Hydrobiologica, Vol. 13, No. 3, p 335-342, 1971. 1 fig, 2 tab, 4 ref.

Descriptors: *Benthic fauna, *Rivers, *Reservoirs, Oligochaetes, Water pollution effects, Diptera, Nematodes, Mollusks, Snails, Biological communities, Ecological distribution.

Identifiers: *Poland, *Tresna (Poland), Sola River (Poland), Lekawka River (Poland), Zylka River (Poland).

The newly constructed reservoir at Resna, Poland was studied in its first year. Sampling was conducted on the reservoir, on the River Sola above and below the reservoir, and on the Lekawka and Zylka Rivers. As has been commonly observed in such reservoirs, the first organisms to appear in the bottom fauna were Chironomidae larvae and Oligochaeta. Oligochaeta prevailed in the deepest place, on a muddy bottom; they occurred in masses amounting to 15,000 specimens/sq. m. Where the bottom was covered with decaying plants, Chironomidae were the most numerous. A more diversified composition, especially of Chironomidae larvae, was observed at the point on the old riverbed of the Sola within the upper part of the reservoir where the development of new conditions in the freshly constructed reservoir had not such a marked influence on the formation of a

new community of bottom fauna. The effect of sewage flowing from industrial establishments into the Sola could also be observed at this point, mainly demonstrated by the occurrence of the species Chironomus thummi, typical of a strongly polluted water and by poorer fauna. (Jones-Wisconsin)

W72-10612

PLANKTONIC BLUE-GREEN ALGAE: GROWTH AND ODOR-PRODUCTION STUDIES.

North Texas State Univ., Denton. Dept. of Biological Sciences; and Tedelyne Brown Engineers, Huntsville, Ala. and East Tennessee State Univ., Johnson City, Dept. of Biology.

J. K. Silvey, D. E. Henley, and J. T. Wyatt. Journal of the American Water Works Association, p 35-39, January 1972. 2 fig, 47 ref.

Descriptors: *Domestic water, *Cyanophyta, Reservoirs, Odor-producing algae, Southwest U.S., Temperature, Oxygen, Light intensity, Nutrients, Actinomycetes, Taste, Eutrophication. Identifiers: Anabaena circinalis, Anabaena cylindrica, Aphanizomenon flos-aquae.

Production and control of blue-green algae, especially those responsible for taste and odor in water supplies, are surveyed. Blue-green algal blooms in Southwestern reservoirs almost always cause taste and odor problems. Major offenders are the heterocystous blue-green forms, particularly Anabaena circinalis and Aphanizomenon flos-aquae. The bottom waters of a reservoir should be examined to determine the physicochemical and biological parameters influencing these blooms. Control has been primarily limited to chemical treatment of the water in treatment plants. Activated carbon removes some odor; chlorine removes some tastes and odors, but it is known to intensify others. The most logical method of controlling tastes and odors in water supplies is to research their source. New approaches of economic importance include use of weak electrolytes to cause lysis of algal cells, use of viral agents and bacteria that lyse blue-green algae, and development of agents that would gradually release algicides while floating or after sinking to the bottom. Manipulation of ecological conditions may prove to be the most desirable control method. Experimentation in this area has included forced aeration and circulation and continuous low-level supplies of nitrogen compounds. (Jones-Wisconsin)

W72-10613

PRELIMINARY MEASUREMENTS OF MID-SUMMER METABOLISM IN BEDS OF EEL-GRASS, ZOSTERA MARINA, Rhode Island Univ., Kingston. Graduate School of Oceanography.

S. W. Nixon, and C. A. Oviatt. Ecology, Vol. 53, No. 1, p 150-153, Winter 1972. 4 fig, 2 tab, 14 ref.

Descriptors: *Metabolism, *Measurement, *Aquatic plants, Marine plants, Productivity, Dissolved oxygen, Tidal streams, Turbulence, Currents (Water).

Identifiers: *Elgrass, Ninigret Pond (R.I.), Narrows River (R.I.).

Gas exchange measurements of total production and respiration made during the summer were used to study marine eelgrass communities (*Zostera marina*) in a coastal pond and a tidal river. Water circulation was minimal over a *Zostera* bed covering large areas of shallow, flat-bottomed Ninigret Pond. Pond tidal range was only few centimeters, salinity relatively constant, and drift bottles and dye in the water spread out slowly, thus a constant resident water mass was assumed. The changing velocity of water flow over a *Zostera* bed in a tidal river showed effect of current speed on metabolism. Total system production and respiration were measured by taking

water samples upstream and downstream of the grass bed. The pond metabolism measurements were 2.9 g oxygen/sq. m per day for apparent production and 3.6 g oxygen/sq. m per day for night respiration. The excess of consumption over production during a full day in early August is indicative of midsummer plant decline. Measurements of upstream-downstream dissolved oxygen in the tidal river showed unusual transients and occasional high values for production and respiration which may be related to turbulent tidal transport, to oxygen exchanges between water and lacunar spaces within *Zostera*, and to higher metabolic rates in faster currents. (Jones-Wisconsin)

W72-10615

VARIABLE RESPIRATION IN AQUATIC PLANT COMMUNITIES.

Pennsylvania State Univ., University Park. Dept. of Civil Engineering; and Westinghouse Electric Corp., Pittsburgh, Pa.

A. J. McDonnell, and D. W. Weeter. Journal of the Sanitary Engineering Division, American Society of Civil Engineers, Vol. 98, No. SA2, p 325-339, 1972. 6 fig, 4 tab, 21 ref.

Descriptors: *Respiration, *Aquatic plants, *Oxygen, Dissolved oxygen, Temperature, Waste assimilation capacity, Streams, Seasonal, Eutrophication, Diurnal, Mathematical studies.

The respiratory response of *Potamogeton crispus* and *Elodea canadensis* to changes in oxygen concentration, temperature, and exogenous nutrient additions is evaluated. Criteria were developed for evaluation of the effect a varying plant respiration rate can have on these estimations of primary productivity in eutrophic systems and the waste assimilation capacity of receiving streams. The respiration patterns are defined on a seasonal basis for various concentrations of dissolved oxygen and temperature levels. Oxygen consumption rates increased from 0.2 to 2.8 mg oxygen/g/hr with increases in dissolved oxygen concentration ranging from 0 to 18 mg/l. A relationship for oxygen consumption within this range of oxygen concentration is described by an empirical equation. Batch data gave results comparable to continuous flow data when analyzed according to the suggested empirical relationship. Increase of temperature increases the oxygen consumption rate. Existence of a variable respiration pattern in aquatic ecosystems can lead to overestimation of reaeration coefficients in stream oxygen balance studies, when these coefficients are calculated from field observations of dissolved oxygen concentrations and to an underestimation of net primary productivity and daily respiration. Methodology is presented to estimate respiration and reaeration rate values from observed diurnal changes in dissolved oxygen concentrations. (Jones-Wisconsin)

W72-10616

POPULATIONS OF CLADOCERA AND COPEPODA IN DAM RESERVOIRS OF SOUTHERN POLAND.

Jagellonian Univ., Krakow (Poland). Dept. of Hydrobiology.

K. Starzykowa. Acta Hydrobiologica, Vol. 14, No. 1, p 37-55, 1972. 5 fig, 3 tab, 26 ref.

Descriptors: *Biological communities, *Crustaceans, *Rotifers, *Reservoirs, *Ecological distribution, Plankton, Zooplankton, Aquatic populations, Density, Biomass, Growth stages.

Identifiers: *Vistula Basin (Poland), *Cladocera, Rotatoria.

Fauna communities determine the usefulness of the water for technical, water supply, and fish farming purposes. The qualitative and quantitative composition of zooplankton in 10 dam reservoirs on rivers lying in the Vistula Basin were investigated. The plankton was caught, according to the size of the reservoir, in vertical sections from several sampling places in the pelagic and littoral

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zones, and from the bottom. The 90 species found contained 37 Rotatoria, 32 Cladocera, and 21 Copepoda; features of the dominant populations of Cladocera and Copepoda were analyzed. The water steps contained the most varied crustacean plankton where the diversity index amounted to 23-25. The lowland reservoir at Kozlawa Gora and one submontane at Roznow contained the most uniform plankton. The magnitude of zooplankton production depended on the rate of water exchange and on the reservoir age. The population development in the course of the season was distinguished by three types of curves; in the majority of reservoirs seasonal maxima were simultaneously attained by two populations. Mature individuals prevailed in the Cladoceran populations. The Copepoda age distribution of some populations was similar in several of the reservoirs whereas in others it was entirely different. (Jones-Wisconsin)
W72-10617

ZOOPLANKTON OF THE DAM RESERVOIR ON THE SOLA AT TRESNA IN THE FIRST YEAR AFTER ITS CONSTRUCTION,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.

W. Krzanowski.
Acta Hydrobiologica, Vol. 13, No. 3, p 323-333, 1971. 3 fig, 1 tab, 9 ref.

Descriptors: *Zooplankton, *Reservoirs, Water pollution effects, Rotifers, Protozoa, Crustaceans, Spatial distribution, Copepods.
Identifiers: *Sola River (Poland), Tresna (Poland), Polyarthra vulgaris, Rotatoria.

In the first year after construction of a reservoir on the River Sola at Tresna, Poland, horizontal and vertical distribution of zooplankton in the reservoir, its suppliers, and effluent were observed, together with the complex hydrobiological conditions. The quality and quantity of the zooplankton showed fairly large differentiation; in the middle part the richest qualitative composition and greatest number were found; in the upper part, which receives polluted waters, the zooplankton were much less differentiated and occurred in much smaller numbers. The dominant forms were Rotatoria with the species Polyarthra vulgaris and Keratella cochlearis cochlearis and the genus Synchaeta preceding Protozoa and Cladocera. The majority of the zooplankton in the middle part and near the dam concentrated in layers of water 2.5 to 10 m deep. The qualitative and quantitative composition of zooplankton below the dam was comparatively poor, due to the way water is released. Interrelations of the groups and even species were similar to those in the reservoir bottom near the dam. Only a few sporadically occurring zooplankton were observed above the reservoir resulting from pollution and the mountainous character of the inflowing streams. (Jones-Wisconsin)
W72-10618

A TECHNIQUE FOR BIOASSAY OF FRESH-WATER, WITH SPECIAL REFERENCE TO ALgal ECOLOGY,
Freshwater Biological Association, Ambleside (England). Windermere Lab.; and Polish Academy of Science, Krakow. Lab. of Water Biology.
J. W. G. Lund, G. H. M. Jaworski, and H. Bucka.
Acta Hydrobiologica, Vol. 13, No. 3, p 235-249, 1971. 3 fig, 2 ref.

Descriptors: *Analytical techniques, *Testing procedures, *Bioassay, *Algae, Freshwater, Measurement, Diatoms, Eutrophication.
Identifiers: British Isles.

The use of bioassay enlarges knowledge of algal ecology as obtained on the basis of their growth in cultures. Among other uses it can be applied for determination of the potential fertility of waters, as well as utilized for their differentiation. A technique for bioassay of freshwater and possibilities of its practical application are described. The

growth of the algae in the samples is a measure of the relative potential, qualitative and quantitative, fertilities of these waters. The method described has already been of value in unpublished tests on water from British lakes. It consists basically of the collection of a water sample, filtration of the water through glass fiber into flasks, addition of a test alga to all these flasks and of certain substances, such as nutrients, to some of the flasks. The water in the flasks is transferred to experimental transparent or translucent containers which are then exposed for given times to constant conditions of light and temperature. To reduce chemical contamination or alteration of the water sample to a minimum, all glassware and other equipment is cleaned and washed very carefully. (Jones-Wisconsin)
W72-10619

THE MICROBIOLOGICAL DECOMPOSITION OF TRIBASIC CALCIUM PHOSPHATE IN THE ILAWA LAKES,
Wyzsza Szkoła Rolnicza, Olsztyn-Kortowa (Poland). Katedra Mikrobiologii Technicznej.
S. Niewołak.

Acta Hydrobiologica, Vol. 13, No. 2, p 131-145, 1971. 6 fig, 3 tab, 25 ref.

Descriptors: *Cycling nutrients, *Microbial degradation, *Phosphates, Lakes, Bottom sediments, Bacteria, Pseudomonas, Fertilization.

Identifiers: *Phosphoric bacteria, *Tribasic calcium phosphate, Phosphorus dynamics, Ilawa Lakes (Poland).

The Lakes Jeziorka Maly and Jeziorka in Poland's Ilawa region were studied during 1968-1969. Jeziorka Maly is a sheltered reservoir, not subjected to wind action, into which wastes from the nearby dairy and part of the municipal sewage penetrate. Jeziorka is polluted by the town only in the southern part. Surface water from a depth of 30 cm, water 20 cm from the bottom, and the superficial sediment layers were investigated. In the quantitative and qualitative composition of microflora acting in the degradation of tribasic calcium phosphate in the water and bottom sediments in the annual cycle, considerable differences were noted in the development of the respective microorganisms, according to the degree of water pollution, the time of the year, and the type of the bottom. Among bacteria decomposing tribasic calcium phosphate, strains of the genus Micrococcus, Aeromonas, Pseudomonas, Escherichia, and Bacillus were identified. The greatest accumulation of phosphates in experimental vessels occurred during the period of the maximum development of 'phosphoric' bacteria, permitting the assumption that by increasing the numbers of appropriate microorganisms (by fertilization) the process of decomposition of poorly soluble mineral phosphoric compounds can be intensified in the water and bottom sediments of a reservoir. (See also W72-10621 and W72-10622) (Jones-Wisconsin)
W72-10620

THE PARTICIPATION OF SOME BACTERIA IN THE SYNTHESIS OF VITAMIN B12 IN THE WATER OF THE ILAWA LAKES,
Wyzsza Szkoła Rolnicza, Olsztyn-Kortowa (Poland). Katedra Mikrobiologii Technicznej.
S. Niewołak, and M. Sobierska.

Acta Hydrobiologica, Vol. 13, No. 2, p 147-158, 1971. 3 fig, 1 tab, 36 ref.

Descriptors: *Biochemistry, *Aquatic bacteria, *Vitamin B, *Synthesis, Lakes, Pseudomonas, Azotobacter, Microorganisms, Coliforms.

Identifiers: *Ilawa Lakes (Poland), Bacillus, Aeromonas, Vibrio, Micrococcus, Azotobacter agile.

The percentage occurrence of bacteria able to synthesize vitamin B-12 in the microflora of the Ilawa lakes (Jeziorka Maly and Jeziorka, lying in the Masuria Lake District, Poland) and of the in-

tensity of this synthesis were determined. Strains (750) of various bacteria were isolated in the years 1967-1968 from the aqueous environment of these reservoirs. Among bacteria synthesizing vitamin B-12 the most numerous in Jeziorka Maly were of the genus Pseudomonas and Bacillus, and in Lake Jeziorka, species of the genus Aeromonas and Vibrio, as well as strains of the genus Micrococcus and Bacillus. Active strains of bacteria were also found in other systematic groups. Most of them synthesized under 0.05 micrograms/ml vitamin B-12. Azotobacter agile strains No. 925 and 932 were particularly active; they synthesized up to 0.16 and 0.17 micrograms/ml vitamin B-12. It is possible that these strains could be put to practical use in the preparation of bacterial manure for fish farms. It may be also that other groups of microorganisms living in the water of the Ilawa lakes, not detected in the present investigations, show similar capabilities. (See also W72-10620 and W72-10622) (Jones-Wisconsin)
W72-10621

A MICROBIOLOGICAL STUDY ON THE HYPONEUSTON OF THE ILAWA LAKES IN THE SUMMER SEASON,

Wyzsza Szkoła Rolnicza, Olsztyn-Kortowa (Poland). Katedra Mikrobiologii Technicznej.
S. Niewołak.

Acta Hydrobiologica, Vol. 13, No. 3, p 295-311, 1971. 8 fig, 1 tab, 33 ref.

Descriptors: *Air-water interfaces, *Microorganisms, *Aquatic life, *Lakes, Phytoplankton, Bacteria, Azotobacter, Solar radiation, Pseudomonas, Plant morphology, Plant physiology, Biochemistry.

Identifiers: *Water surface, *Ilawa Lakes (Poland), Heterotrophic microflora, Hyponeuston.

The quantitative and qualitative composition of the microflora of the surface waters of the Ilawa lakes, Jeziorka Maly and Jeziorka, in Poland's Masuria district were investigated in the summer of 1968. Samples of 1 mm surface water were collected with sterile pipettes, and from the deeper 0.30 m, 0.50 m, and 1 m layers with Isachenko's apparatus. Total number of bacteria, number of heterotrophic bacteria, and the nitrogen fixing bacteria of the genus Azotobacter were determined and morphological, physiological, and biochemical properties were studied. In Jeziorka Maly the prevailing group of microorganisms were bacteria of the genus Pseudomonas, of the Aeromonas-Vibrio group, of the family Enterobacteriaceae, and of the genus Micrococcus. In Lake Jeziorka the predominant strains were Pseudomonas species; species of the Aeromonas-Vibrio group and of the genus Bacillus also occurred in great numbers. In Lake Jeziorka only a minimal number of enterobacteria were found and no species of the genera Flavobacterium and Corynebacterium were found in Jeziorka Maly. The investigations showed that solar radiation is detrimental to the development of microorganisms in the surface water and that Azotobacter is highly resistant to ultraviolet rays. (See also W72-10620 and W72-10621) (Jones-Wisconsin)
W72-10622

ALGAE OF THE LITORAL OF WEST COAST OF SAKHALIN,

T. F. Shchapova, and V. B. Vozzhinskaya.
Available from the National Technical Information Service as AD-724 266, \$3.00 in paper copy, \$0.95 in microfiche. Naval Oceanographic Office Translation 339. Trans. of Vodoraz Litoral: Zapadnogo Pobezh'ya Sakhalina, Trudy Instituta Okeanologii, Vol. 34, p 123-146, 1960. 5 fig, 2 tab, 33 ref.

Descriptors: *Algae, *Littoral, *Aquatic plants, Islands, Ecological distribution, Biological communities, Systematics, Marine plants.

Identifiers: *Sakhalin Island (USSR).

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The western coast of Sakhalin Island was studied on an expedition of the Institute of Oceanology USSR in 1954. The coastal belt including the littoral and sublittoral from Kholo in the north to Ivanovka in the south, about 600 km, is described pointing out type of bottom, amplitude of tides, exposure to waves and effects of warm or cold currents. About 500 qualitative and quantitative samples were obtained and a herbarium of 700 plants was prepared. From 1860 to 1926 various expeditions and investigations sampled algae at several points and the botanical history is given. After the return of South Sakhalin to the Soviet Union from Japan comprehensive studies of algae in the area were undertaken, concentrating on the ecology and practical application of macrophytes. A considerable part of these studies has remained unpublished. In this work algae are defined to the species, also their quantity and distribution are evaluated and described. A comprehensive list of algae in the appendix sums up the location of samples, their size, form, quantity, and distribution. (Jones-Wisconsin)

W72-10623

MEDICAL LEECH OCCURRENCE AND RESERVES IN THE LITHUANIAN SSR, (IN RUSSIAN),

Akademii Nauk Litovskoi SSR, Vilnius. Institut Zoologii i Parazitologii. D. V. Zapkuvene. Tr Akad Nauk Lit SSR. Ser V. Vol 3. p 91-97. 1970. Illus. Map. English Summary.

Identifiers: Fertilizers, Hirudo medicinalis, *Leeches, *Lithuanian SSR, Pesticides, Preservation, Reserves, USSR.

One hundred and seventy-six water reservoirs were investigated for the presence of the medicinal leech, Hirudo medicinalis. This leech was found in 33 reservoirs and was most abundant in the Lazdijai, Prienae, Trakai and Ultene industrial water reservoirs. Population depletion due to the effect of pesticide and fertilizer contamination is discussed. Methods to increase reserves of this useful leech are given.—Copyright 1972, Biological Abstracts, Inc.

W72-10624

EUTROPHICATION,

Freshwater Biological Association, Ambleside (England).

J. W. G. Lund.

Proceedings of the Royal Society of London, B, Vol. 180, p 371-382, 1972. 3 fig, 25 ref.

Descriptors: *Eutrophication, *Nutrients, *Algae, Sewage treatment, Water pollution sources, Water pollution effects, Agricultural runoff, Phosphorus, Nitrogen, Phosphates, Detergents, Potable water. Identifiers: Asterionella formosa, Blelham Tarn (England), Windermere (England).

Although the main causes of eutrophication are well known, there is little detailed understanding of their interaction with other environmental factors; it is not yet possible to forecast the exact changes to be expected in aquatic ecosystems. Over the last 27 years, observations were made on two English Lake District waters—Windermere, receiving the main source of urban sewage, and Blelham Tarn; phytoplankton was examined, usually at weekly intervals; concentrations of phosphates, nitrates, and silicates were also determined weekly nearly all through this period; other chemical analyses have been carried out over shorter periods. The maximum concentration of phosphates has risen in both waters. A comparison of the changes in the abundance and rate of growth of some major algae was made. Results showed that changes in the two waters have not followed the same path. Moreover, certain aspects of the chemical changes in the water are difficult to understand. The increase in phosphate over the years has followed a similar course in each body of water but the average number of cells of Asterionella has decreased in Windermere and increased in Blelham Tarn. (Jones-Wisconsin)

W72-10625

TOXIC EFFECT OF SOME METAL ORGANIC COMPOUNDS ON HYDROBIONTS. I. EFFECT OF ALKYL METHACRYL OXYPLUMBANES, (IN RUSSIAN),

Moscow State Univ. (USSR). Dept. of Hydrobiology.

N. S. Stroganov, V. G. Khobot'ev, D. A. Kochkin, L. V. Kolosova, and G. E. El'khanov. Biol Nauk. Vol 13, No 10, p 13-17. 1970. Illus.

Identifiers: Alkylmethacryloxy, Chlorella vulgaris, Daphnia magna, *Hydrobionts, *Metal organic compounds, *Plumbanes, Scenedesmus quadricauda, *Toxicity.

The algae Scenedesmus quadricauda and Chlorella vulgaris had decreased sensitivity and Daphnia magna had increased sensitivity to the effect of trimethylmethacryl, triethyl-methacryl, dimethylmethacryl and diethylmethacryl oxyplumbane. The dissimilar behavior of the hydrobionts to the same agent suggests its use as a chemical regulator of plankton population in industrial bodies of water.—Copyright 1972, Biological Abstracts, Inc.

W72-10626

EUTROPHICATION ANALYSIS: A MULTIVARIATE APPROACH,

Environmental Health Center, Ottawa (Ontario).

E. E. Shannon, and P. L. Brezonik.

Journal of the Sanitary Engineering Division, American Society of Civil Engineers, Vol. 98, No. SA1, p 37-57, February 1972. 3 fig, 5 tab, 22 ref. OWRR B-004-FLA (8).

Descriptors: *Trophic level, *Eutrophication, *Analysis, Mathematical studies, *Florida, Statistical methods, Lakes.

Identifiers: *Multivariate approach, Trophic state index.

Lake trophic state is envisioned as a multi-dimensional hybrid concept described by several biological, chemical and physical indicators. Using data from 55 north and central Florida lakes and multivariate statistical techniques, relationships between trophic state and watershed land-use and population characteristics were examined. Cluster analysis was used on groups of lakes with similar trophic state characteristics, interpreting these groups in the classical oligotrophic, mesotrophic, and eutrophic conditions. A trophic state index (TSI) was formulated using principal component analysis incorporating seven trophic state indicators. The TSI quantified the concept of trophic state on a numerical scale, thus providing a method for ranking and comparing lake trophic states. A positive correlation exists for Florida lakes between lake trophic state and lake watershed land use and population characteristics. Canonical correlation analysis of several trophic state indicators versus the population and land use characteristics showed high correlation and corroborated the regression results which indicate that the most influential eutrophication factors are the fertilized cropland and urban areas of the lake watershed. (Jones-Wisconsin)

NITROGEN AND PHOSPHORUS CONTENT OF WATER FROM TILE DRAINS AT TWO LEVELS OF MANAGEMENT AND FERTILIZATION,

Cornell Univ., Ithaca, N.Y. Dept. of Agronomy.

For primary bibliographic entry see Field 05B.

W72-10628

PHYSICAL MODELING APPLIED TO COASTAL ZONE POLLUTION PROBLEMS,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

H. B. Simmons, J. Harrison, R. A. Boland, and D. B. Mathis.

Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Miscellaneous Paper Y-72-2, March 1972. 26 p.

Descriptors: *Model studies, *Waste disposal, *Coasts, *Water pollution, *Forecasting, *Harbors, Estuaries, Sediment control.

Identifiers: *Coastal environment, *Scale models, *Physical models.

Pollution problems are more serious in coastal zones than in most other areas because they are desirable locations for residential, commercial, and industrial development; they provide natural locations for man's leisure and nature-related activities; and they appear as an inexhaustible sink for domestic and industrial sewage. It is necessary to determine effects of pollution before pollution takes place. This requires a predictive capability. One tool used to make this predictive capability more meaningful is physical scale modeling—a problem-solving technique that entails development, construction, verification, and testing of a scale model of a particular prototype situation. Physical models are easier and cheaper to work with than the prototype. Different types of physical models are discussed with emphasis on determining extent and duration of pollution within an area. Specific examples include a sediment-trapping plan in Savannah Harbor, effect of an inlet across Sandy Hook in New York Harbor, and pollutant dispersion from two sources in Brunswick Harbor. Laboratory ecosystem modeling is described as a planning tool specifically designed to predict chemical, biological, and ecological phenomena. (WES)

W72-10673

PRELIMINARY EXPERIMENTAL DATA ON THE DYNAMICS OF SR-85 IN ANGUILLA ANGUILLA (L.) (IN FRENCH),

Commissariat à l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucléaires.

G. Marcoux, L. Foulquier, E. Angelier, and A. Grauby.

Available from NTIS as CEA-N-1451, \$3.00 in paper copy, \$0.95 in microfiche. Report CEA-N-1451, May 1971, 14 p, 14 ref, 2 tab, 7 fig.

Descriptors: *Strontium radioisotopes, *Absorption, *Freshwater fish, Food chains, Nuclear wastes, Public health, Radioactivity effects, Water pollution effects, Eels, Animal physiology.

Uptake by three-year-old European Eel from aquaria water maintained at concentrations in the range 1.5-5 microCi/liter was measured. Uptake-time plots are given for organs, from which equilibrium concentration factors were about: 10 for the skeleton, 3 for gills, 2 for skin, 1 for intestine, and less than 1 for other organs. Effects of salinity, calcium, and feeding will be studied. Comparison is made with work by others. (Bopp-ORNL)

W72-10677

SURVEY OF TOXAPHENE LEVELS IN GEORGIA ESTUARIES,

Georgia Univ., Sapelo Island. Marine Inst.

For primary bibliographic entry see Field 05B.

W72-10678

DISPOSAL OF LIQUID WASTES INTO COASTAL WATERS,

Battelle Memorial Inst., Richland, Wash.

For primary bibliographic entry see Field 05B.

W72-10683

CHROMATE POLLUTION OF WATER - DETECTION, EFFECTS, AND PREVENTION: A BIBLIOGRAPHY,

Oak Ridge National Lab., Tenn.

For primary bibliographic entry see Field 05A.

W72-10684

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Effects of Pollution—Group 5C

PHENOL POLLUTION OF WATER: A BIBLIOGRAPHY.

Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 05A.
W72-10685

RADIUM IN AQUATIC FOOD CHAINS: RADIUM UPTAKE BY FRESH WATER ALGAE,

Atomic Energy of Canada Ltd., Chalk River (Ontario).

B. Havlik.
Radiation Research Vol 46, No. 3, June 1971, p 490-505 10 fig, 3 tab, 31 ref.

Descriptors: *Radioisotopes, *Radium, *Absorption, *Path of pollutants, *Water pollution, Water pollution sources, Aquatic algae, Food chains, Measurement, Adsorption.

Identifiers: Concentration, Uptake.

Accumulation of 226Ra was studied in four species of green algae and two species of blue-green algae. Algae were cultivated in organic culture. Radium was added in amounts of 1 micro Ci/l., 0.1 micro Ci/l. and 0.01 micro Ci/l. After 14 days the amount of radium in the medium in dead and living algal cells, and in washes from the algae, was determined at intervals using a liquid scintillation counter. From 50 to 80% of the radium was absorbed within the cells and the amount absorbed was proportional to the length of exposure. Radium was mostly adsorbed on the cell surface (25-50%) and only 1-8% was present within the cells. The highest accumulative factor was reached after 24 hours exposure. The accumulative factor of the radium absorbed by the algae was inversely proportional to concentration of radium in the medium and was dependent on: the species of algae; the concentration radium in the medium; the growth rate of the algae and their physiological condition; the period of exposure. The factors responsible for radium accumulation were adsorption, absorption and incorporation, in that order of importance. (Houser-ORNL)

W72-10686

GAMMA EMITTERS IN EUPHAUIDIIDS FROM THE SOUTHEAST PACIFIC OCEAN,

Chile Univ., Vina del Mar. Departamento de Oceanologia; and Oregon State Univ., Corvallis. For primary bibliographic entry see Field 05B.

W72-10693

EFFECT OF A MIXTURE OF URANIUM FISSION PRODUCTS ON THE SANITARY CONDITIONS AND HYDROBIONTS OF WEAKLY-MINERALIZED FRESH-WATER BASINS, (IN RUSSIAN),

V. N. Guskova, A. N. Bragina, A. A. Zasedatelev, B. N. Ilyin, and V. M. Kupriyanova.

Gidrobiol. Zh., Vol 6, No. 4, p 5-11, 1970, 3 tab, 3 fig.

Descriptors: *Radioisotopes, *Radioactivity effects, *Radioecology, *Reservoirs, *Freshwater, Hydrobiology, Algae, Fish, Absorption, Bioassay, Metabolism.

Identifiers: Concentration, Muscle, Bone Physiology/Metabolism.

Experimental investigations did not establish a considerable negative effect of two mixtures of fission radionuclides in concentrations of 2.0×10^{-1} and 1.0×10^{-5} Ci/l on sanitary conditions and hydrobionts of a reservoir. A concentration of the mixtures of 1.0×10^{-3} Ci/l caused inhibition of biochemical consumption of oxygen and development of fish spawn. A decrease in concentration of mixtures (radionuclides) in water occurred most intensively (by 50 to 60%) as compared with the initial one due to *Protococcus* algae and duckweed. The lowest values for the accumulation coefficients of the separate isotope mixtures, the concentration being 1.0×10^{-8} Ci/l in water, were found in the muscles of fish. Axis skeloion accumulated mainly 89Sr and 140Ba. (Houser-ORNL)

W72-10694

REPRODUCTIVE SEASONS OF EIGHT FRESH-WATER MUSSELS FROM THE WABASH, WHITE, AND EAST FORK OF THE WHITE RIVERS OF INDIANA,

Louisville Univ., Ky. Water Resources Lab.

R. L. Bingham.

Available from the National Technical Information Service as COM-72 10270, \$3.00 in paper copy, \$0.95 in microfiche. May 1968, 132 p, 24 fig, 13 ref, append.

Descriptors: *Indiana, *Mussels, Reproduction, Mollusks, Seasonal, Breeding, Fecundity, Management, Water pollution, Fisheries.

Identifiers: *Wabash River (Ind), *White River (Ind).

The breeding season of several commercial valuable freshwater mussels was determined by microscopic examination of stained gonadal tissues of male and female individuals and examination of the gills of female specimens. The length of the breeding season was established by correlating seasonal variations in the physiological development of male and female gonads with the presence or absence of eggs in the marsupium. The gonads of *Quadrula quadrula Rafinesque* (Pelecypoda:Unionidae) were selected for intensive investigation. The breeding season was determined for *Q. quadrula*, *Q. metanevra Rafinesque*, *Q. pustulosa* (Lea), *Obovaria olivaria* (Rafinesque), *Tritogonia verrucosa*, *Rafinesque*, *Megalonaia gigantea* (Barnes), *Amblema costata Rafinesque*, and *Actinonaias carinata* (Barnes). It was established that conservation of the freshwater mussel resources of Indiana probably can be accomplished most readily by extending the closed season to mid-June, by decreasing the amount of pollution entering the Wabash River Basin, and by eliminating diving and all power-assisted methods of mussel harvesting.

W72-10695

LETHAL TEMPERATURES OF ROACH FRY (*RUTILUS RUTILUS L.*) FROM LAKES WITH NORMAL AND ARTIFICIALLY ELEVATED TEMPERATURE,

Instytut Rybactwa Srodowiskowego, Zabieniec (Poland). Dept. of Fish Culture.

L. Horoszewicz.

Polskie Archiwum Hydrobiologii, Vol. 18, No. 1, p 69-79, 1971. 4 fig, 1 tab, 15 ref.

Descriptors: *Fish physiology, *Environmental effects, *Water temperature, *Thermal pollution, Water pollution effects, Growth stages, Fish diseases, Incubation, Temperature, Aquatic environment, Heated water, Lethal limit.

Identifiers: *Acclimation, *Rutilus* spp, Roach, Fish development, Slesin Lake (Poland), Lichen Lake (Poland).

Reactions to high incubation temperatures have been compared for roach fry from natural spawning grounds in a lake with normal temperature (Slesin) and in an artificially elevated one (Lichen), as well as for roach fry incubated in various temperatures in laboratory conditions. No significant differences in lethal temperatures between populations have been found, and the values of these temperatures depended upon incubation temperatures. An additional acclimation of fry in elevated temperatures caused an appropriate increase in their lethal temperatures. When fry were kept in sublethal temperatures for 100 hr, a somewhat lesser mortality was observed in the groups from the heated Lake Lichen. (LeGore-Washington)

W72-10786

AN EMPIRICAL BIOTIC INDEX OF THE QUALITY OF WATER IN SOUTH AFRICAN STREAMS AND RIVERS,

National Inst. for Water Research, Congella (South Africa). Regional Lab.

F. M. Chutter.

Water Research, Vol. 6, p 19-30, 1972. 2 fig, 4 tab, 33 ref.

Descriptors: *Methodology, *Annual succession, *Aquatic animals, *Analytical techniques, *Pollution (Stream), *Indicators, *Evaluation, Benthos, Invertebrates, Water quality, Seasonal, Biorhythms, Biological communities, Dominant organisms, Environmental gradient, Water pollution effects.

Identifiers: *Biotic index, Faunal analysis, Riffle organisms, Organic pollution.

A method of reducing data on stones-in-current faunal communities to a linear scale of water quality in terms of organic pollution is presented. Using data from extensive river surveys each taxon has been allotted a Quality Value (between 0 and 10) related to its occurrence in variously polluted waters. To arrive at the Biotic Index Value of a community, a faunal sample is taken and the individual animals are recorded by taxa. The number of individuals in each taxon is then multiplied by the taxon's Quality Value. The products of these multiplications are summed for the sample and this sum is then divided by the total number of individuals in the whole sample to give the Biotic Index Value. Quality Values for taxa occurring in large numbers in a wide range of water qualities vary according to the diversity and abundance of the Baetid Ephemeroptera. It is not necessary to identify all animals to the species level and sample size is not critically important. The Biotic Index is compared with other indices. Examples of the procedure using data from South African waters are given. (Katz-Washington)

W72-10788

THE EFFECTS OF SALMON CANNERY WASTE ON WATER QUALITY AND MARINE ORGANISMS AT PETERSBURG, ALASKA 1971,

Washington Univ., Seattle. Fisheries Research Inst.

R. E. Nakatani, D. L. Beyer, and C. P. Staude. Report to National Cannery Association, Seattle, Washington, 1971. 47 p, 18 fig, 5 tab, 8 ref, 4 app.

Descriptors: *Water pollution effects, *Canneries, *Food processing industry, *Dissolved oxygen, *Industrial wastes, *Birds, Water pollution sources, Fish handling facilities, *Alaska, *Industrial wastes, Salmonids, Ecology, Aquatic environment, Marine fish, Benthos, Seasonal, Intertidal areas, Turbidity, Hydrogen ion concentration, Salinity, Biochemical oxygen demand, Water temperature, Tidal effects.

Identifiers: *Cannery wastes, Intertidal fauna, Substrate, Sea birds, Sunlight intensity, *Peterburg (Alas).

A thorough biological and chemical investigation of marine waters adjacent to a salmon cannery indicated no changes resulting from cannery operations. Local daily and seasonal environmental changes influenced water quality parameters. (Katz-Washington)

W72-10789

EFFECT OF MS-222 ON BLOOD SUGAR AND LIVER GLYCOGEN IN RAINBOW TROUT,

Bureau of Sport Fisheries and Wildlife, Bishop, Calif.

G. J. Crowley, and D. J. Berinati.

Transactions of the American Fisheries Society, Vol. 101, No. 1, p 125-128, January 1972. 2 fig, 5 ref.

Descriptors: *Rainbow trout, *Fish physiology, *Water temperature, Methodology, Freshwater fish, Environmental effects, Fish control agents, Chemcontrol.

Identifiers: *Anesthetics, *MS-222, *Tricaine methanesulfonate, Blood glucose, *Liver glycogen, Glycogen, Glucose, *Blood sugar.

The blood glucose level and the liver glycogen levels of rainbow trout exposed to MS-222 (tricaine methanesulfonate, Sandoz) at different concentrations was different at water temperatures of 3 C and 11 C. For both parameters, concentrations were higher at 3 C than at 11 C. (Katz-Washington)

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects of Pollution

W72-10790

STANDARD ERROR OF LC-50 AND SAMPLE SIZE IN FISH BIOASSAYS,
Tennessee Valley Authority, Muscle Shoals, Ala.
A. L. Jensen.
Water Research, Vol. 6, p 85-89, 1972. 1 fig, 4 ref.

Descriptors: *Bioassay, *Statistical methods, *Lethal limit, *Sampling, *Mathematical studies, Thermal water.
Identifiers: *LC-50, Pimephales spp., Probit analysis.

The relationship between the relative error and sample size in fish bioassays was investigated empirically and theoretically. If the mean concentration tested is near the estimated LC-50 and the same sample size is used at each test level, the dependence of relative error on sample size is predictable. Increasing the sample size significantly reduces the standard error of the estimated LC-50 until the sample size reaches about 30 fish. (Katz-Washington)
W72-10791

THE DETERMINATION OF THE ACUTE TOXICITY OF HERBICIDES TO PHYTOPLANKTON (ZUR BESTIMMUNG DER AKUTEN TOXIZITAET VOL HERBIZIDEN GEGENUEBER PHYTOPLANKTON),
Institut fuer Wasserwirtschaft, Berlin (East Germany).
M. Tscheu-Schlueter.
Fortschritte der Wasserchemie, Vol. 14, p 159-168, 1972. 3 fig, 3 tab, 15 ref.

Descriptors: *Herbicides, *Toxicity, *Dalapon, *Chlorophytia, Carp, Bioassay, Lethal limit, Water pollution effects, Pesticide toxicity.
Identifiers: *Acute toxicity, *MCPA, *Dichloroprop, *2-4 dichlorophenoxy propionic acid, Ankistrodesmus spp., Pure cultures, Statistical analysis.

The acute toxicity of three selected herbicides (SYS 67 Omnidel-Kombi, SYS 67 ME and SYS 67 Prop) to the green alga Ankistrodesmus falcatus was determined. The effect of the herbicides was tested in graduated concentrations on pure cultures of the alga species mentioned. For the evaluation of the test series, counts by means of Thoma chambers were carried out and a statistical treatment of average values of cell numbers was made subsequently to ascertain significant divergences from the control samples. The three tested herbicides are weakly toxic to one summer old carp and the mentioned alga, so their application according to the regulations will not result in acute water pollution problems. (Katz-Washington)
W72-10792

SUSPENDED SOLIDS AND FISHERIES,
Department of the Environment, Stevenage (England).
J. S. Alabaster.
Proceedings of the Royal Society of London B, Vol. 180, p 395-406, 1972. 4 fig, 39 ref.

Descriptors: *Montmorillonite, *Clays, *Suspended solids, *Bentonite, *Gypsum, Clay minerals, Benthos, Aquatic drift, Fish food organisms, Wood wastes, Iron, Copper.
Identifiers: China clay, Wood fiber, Inert solids, Iron hydroxide.

The effect of suspended solids on freshwater fish is illustrated from field and laboratory studies on china-clay wastes together with work on the effects of other chemically inert material, wood fiber, ferric hydroxide, and oxidizable organic solids, and mention is made of work in the marine environment. Tentative water quality criteria formulated by the European Inland Fisheries Advisory Commission for inert suspended solids and inland fisheries are outlined and compared with conditions prevailing in rivers in the United Kingdom. Reference is made to current work by the Water

Pollution Research Laboratory on the role of organic suspended matter in the presence of soluble poisons and on the effect of hydraulic conditions on the settlement and oxidizability of suspended solids from sewage effluent. (Katz-Washington)
W72-10793

ORIENTATION OF GOLDFISH (CARASSIUS AURATUS) IN RESPONSE TO A SHALLOW GRADIENT OF A SUBLETHAL CONCENTRATION OF COPPER IN AN OPEN FIELD,
Texas A and M Univ., College Station.
H. Kleerekoper, G. F. Westlake, J. H. Matis, and P. J. Gensler.

Journal of the Fisheries Research Board of Canada, Vol. 29, No. 1 p 45-54, 1972. 5 fig, 6 tab, 45 ref.

Descriptors: *Methodology, *Copper, *Toxicity, *Fish behavior, *Bioassay, Metals, Behavior, Attractants, Heavy metals, Sodium chloride, Laboratory equipment, Research equipment, Fish attractants, Water pollution effects.
Identifiers: *Copper chloride, *Heavy metal pollution, Chloride ions, Goldfish, Carassius spp., Sublethal concentrations, Sublethal effects.

In slowly flowing water, seven naive goldfish 30 cm long changed their locomotor behavior upon entering a mass of water containing shallow gradients of copper chloride. The concentration was 11-17 $\mu\text{g/l}$ Cu (2+) in most of this mass, with small isolated pockets containing maximally 50 $\mu\text{g/l}$. The amount of time spent by the fish, the average size of turn, and the variance of the size of turn increased in the 'polluted' region. The orientation of the fish in this region deviated consistently in the upstream direction resulting in the increase in time spent in the area of highest concentration. Comparison of the locomotor behavior of the fish in sodium chloride of the same concentration and in laboratory water established that the changes mentioned were in response to the copper rather than the chloride ion. These concentrations of copper ion were either attractive to the fish or entrapped them. (Katz-Washington)
W72-10794

COLONIZATION AND SUCCESSION OF FRESH-WATER PROTOZOANS IN POLYURETHANE FOAM SUSPENDED IN A SMALL POND IN NORTH CAROLINA,
Virginia Polytechnic Inst. and State Univ., Blacksburg, Dept. of Biology.
W. H. Yongue, Jr., and J. Cairns, Jr.
Notulae Naturae of the Academy of Natural Sciences of Philadelphia, No. 443, November 30, 1971. 13 p, 8 tab, 11 ref.

Descriptors: *Artificial substrates, *Methodology, *Aquatic animals, *Protozoa, North Carolina, Water temperature, Hydrogen ion concentration, Hardness (Water), Dissolved oxygen, Limnology.
Identifiers: *Colonization, Polyurethane floats, Species lists.

Units of hexahedrally shaped polyurethane foam were placed at 2.5 foot intervals at the surface of a small artificial pond near Charlotte, North Carolina to remain from 23 December 1969 to 2 June 1970. Weekly determinations of the number of protozoan species inhabiting foam units as well as water temperature, pH, hardness and dissolved oxygen were made. Each week a foam unit previously unsampled was sampled and some of these were sampled several times during the 23 weeks. A total of 96 species were identified during the first 18 weeks of the study. Of these 29 species had appeared by the end of the second week. An average of 54.8% of the species found in initial samplings were 'resident' species (i.e. a group that persisted throughout the study period). After the first two weeks there were three weeks in which 9 or 10 new species colonized the foam units. Most of these were lost rather quickly. The number of species present at any one time ranged from 15 (end of first week) to 43 (end of 19th week). The oscillations

appear to have been caused by appearance and disappearance of transient species. (Katz-Washington)
W72-10795

EUTROPHICATION AND FISH MORTALITY IN TWO PONDS AT OSTEN (EUTROFIERING EN VISSTERFE IN TWEE PARKVLIJVERS TO OOSTENDE),
Ghent Rijksuniversiteit (Belgium).

R. Jocque, and G. Persoone.
Natuurwet. Tijdschr. Vol. 52, p 168-198, 1970. 9 fig, 3 tab, 33 ref. (English summary).

Descriptors: *Eutrophication, *Fishkill, *Ammonia, *Nitrites, *Hydrogen sulfide, Mortality, Limnology, Oxygen sag, Water pollution effects, Water quality, Cyanophyta, Toxicity, Ponds, Freshwater fish, Hydrogen ion concentration.
Identifiers: Belgium, Oscillatoria, Ammonia.

A sampling program was instituted to determine causes of fish mortalities in a park in Ostend, Belgium. Physical and chemical analyses, as well as qualitative and quantitative plankton studies were made. Results indicated the ponds were hypertrophic with a dominant population of blue-green algae. Ponds were regarded as alpha-mesosaprobic. A continuous presence of nitrites indicated ammonia in the deeper waters. The blue-green algae, Oscillatoria redekei, indicated the presence of hydrogen sulfide in the sediments. An oxygen deficiency rendered the fish intolerant to chronic poisoning by NH₃ and H₂S. (Katz-Washington)
W72-10796

MARINE POLLUTION BIOASSAY BY USING SEA URCHIN EGGS IN THE INLAND SEA OF JAPAN (THE SETO-NAIKAI),
Doshisha Univ., Kyoto (Japan).

N. Kobayashi, H. Nogami, and K. Doi.
Publications of the Seto Marine Biological Laboratory, Vol. 19, No. 6, p 359-381, March 1972. 4 fig, 1 tab, 3 ref.

Descriptors: *Bioassay, *Toxicity, *Water pollution effects, *Embryonic growth stage, *Water quality, Bioindicators, Laboratory animals, Lethal limit, Water pollution sources, Fertilization, Inhibition, Growth stages, Chemical oxygen demand, Metals.
Identifiers: Sea urchin, Anthocidaris spp., Japan, Egg fertilization.

A series of bioassays was made to examine the inhibitory degree of the polluted seawater in the Inland Sea of Japan upon the fertilization and further development of sea urchin eggs. The indicator stages and states were the fertilization, first cleavage, gastrulation, and such anomalies as polyspermic cleavage, permanent blastula and exogastrula. The inhibitory effects on the fertilization, first cleavage and gastrulation were not regularly correlated with the COD VALUES; A POSITIVE REACTION WAS SEEN ONLY AT VERY HIGH VALUES OF COD. A relation between heavy metals in the bottom mud and inhibitory effects of the bottom water is possible, as the induction of permanent blastula or exogastrula was noted in areas around metal refinery works. A tentative ranking of inhibitory degrees of polluted water samples upon the fertilization and further development of sea urchin eggs is proposed. (LeGore-Washington)
W72-10797

INSECTICIDE RESIDUES IN A STREAM AND A CONTROLLED DRAINAGE SYSTEM IN AGRICULTURAL AREAS OF SOUTHWESTERN ONTARIO, 1970,
Department of Agriculture, London (Ontario).
For primary bibliographic entry see Field 05B.
W72-10798

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Effects of Pollution—Group 5C

MOBILIZATION OF MERCURIC SULFIDE FROM SEDIMENT INTO FISH UNDER AEROBIC CONDITIONS,
Fisheries Research Board of Canada, Winnipeg
(Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 05B.
W72-10799

BRINE SHRIMP (ARTEMIA SALINA L.) LARVAE AS A SCREENING SYSTEM FOR FUNGAL TOXINS,
Department of National Health and Welfare, Ottawa (Ontario). Food and Drug Research Lab.
J. Harwig, and P. M. Scott.
Applied Microbiology, Vol. 21, No. 6, p 1011-1016, June 1971. 4 tab, 21 ref.

Descriptors: *Bioassay, *Bioindicators, *Brine shrimp, Toxicity, Laboratory animals, Lethal limit, Water pollution effects.
Identifiers: *Fungal toxins, Mycotoxins.

Concentrations resulting in 50% mortality of brine shrimp larvae exposed to known mycotoxins for 16 hr were (mg/l): aflatoxin G sub 1, 1.3; diacetoxyscirpenol, 0.47; gliotoxin, 3.5; ochratoxin A, 10.1; and sterigmatoxystin, 0.54. 4-Acetamido-4-hydroxy-2-butenoic acid gamma-lactone caused no mortality at 10 mg/l. The larvae were relatively sensitive to aflatoxin B sub 1, diacetoxyscirpenol, gliotoxin, kojic acid, ochratoxin A, rubratoxin B, sterigmatocystin, stenophane, and T-2 toxin. The larvae were only moderately sensitive to citrinin, patulin, penicillic acid, and zearelenone. They were relatively insensitive to griseofulvin, luteoskyrin, oxalic acid, and beta-nitropropionic acid. The disc screening method indicated that 27 out of 70 fungal isolates from foods and feeds grown in liquid or solid media produced chloroform-extractable toxic material. (LeGore-Washington)
W72-10800

MICROBIAL DEGRADATION OF OIL,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
For primary bibliographic entry see Field 05G.
W72-10801

THE BIODEGRADATION OF OIL,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
For primary bibliographic entry see Field 05G.
W72-10802

THE EFFECTS OF SUSPENDED SILTS AND CLAYS ON SELF-PURIFICATION IN NATURAL WATERS: PROTEIN ADSORPTION,
Alaska Univ., College. Inst. of Water Resources. A. P. Murray.
Available from the National Technical Information Service as PB-210 748, \$3.00 in paper copy, \$0.95 in microfiche. Report No. IWR-23, 1972. 52 p, 17 fig, 15 ref. OWRR A-030-ALAS (2).

Descriptors: Sediments, *Adsorption, *Proteins, *Self-purification, *Alaska, *Silts, Water temperature, *Hydrogen ion concentration, *Clays, Farm wastes, Water pollution control.
Identifiers: Sub-arctic rivers, *Suspended sediments, Protein equilibrium, *Bovineserum albumin.

The effects of the suspended sediments found in many natural waters on the microbial processes involved in the self-purification of those waters are not known. Clays and silts with their large surface area per unit weight have an immense capacity for adsorbing nutrient molecules from solution, but the extent to which such adsorption takes place is largely unknown. Adsorption of a major portion of a biodegradable substance from solution onto a solid surface would significantly alter its susceptibility to bacterial attack and, hence, also the rate at which it is decomposed. Results are reported of

adsorption experiments with soil materials found in some Alaskan waters which are typically heavily sediment-laden. The affinities of these soils for the protein bovine serum albumin were measured as a function of pH, temperature, and protein concentration. An empirical relationship was discovered, for a given soil material, between the equilibrium protein concentration and the initial protein-to-soil ratio. Temperature variations from 5 to 25 deg. C had no detectable effect on adsorption, whereas variations in pH between 2 and 10 had dramatic effects on the extent of adsorption. The amount of protein adsorbed at the pH of the natural water system was so small as to predict that adsorption of this protein onto suspended sediments would have a negligible effect on the rate at which the protein would be decomposed by bacteria in the aqueous environment.
W72-10808

THE BACTERIA OF AQUATIC ENVIRONMENTS IN POWER STATIONS,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.

J. E. Rippon.

In: Symposium on Freshwater Biology and Electrical Power Generation, April 22, 1971, Part 2, p 95-114, 2 fig, 6 tab, 17 ref.

Descriptors: *Aquatic environment, *Aquatic bacteria, *Powerplants, *Ammonia, Natural streams, Condensers, Boiler feed water, Corrosion, Lubricants, Resins, Cultures, Temperature, Nutrients, Resistance, *Thermal pollution.

The isolation and examination of bacteria from the aquatic environments of power stations are described. The environments that have been investigated include natural waters, demineralized water of cable cooling circuits, condensate associated with turbine lubricating oils and condenser slimes. Ammonia has been assumed to cause stress corrosion cracking in condenser tubes since it is the most active environmental factor known. Concentrations of the order of 500 ppm of ammonia have been measured in slimes on a dry basis. The aquatic microbial population in the condenser series was the most heterogeneous, and the oil strains the most homogeneous. Oil strains differ from the other groups in their lack of color, greater motility, non-photosynthetic nature and in many of the biochemical tests. The occurrence of a particular fungus in several samples of demineralized water may mean that this organism is adapted to growth on resins. (Upadhyaya-Vanderbilt)
W72-10811

THE CALEFACTION OF LAKE TRAWSFYNYDD,
Liverpool Polytechnic (England). Dept. of Biology.

D. R. Rothwell.

In: Symposium on Freshwater Biology and Electrical Power Generation, April 22, 1971, Part 2, p 115-130, 9 fig. Central Electricity Research Laboratories.

Descriptors: *Thermal pollution, *Insects, Cooling water, Oligotrophy, Mud, Temperature, Life cycles, Nuclear powerplants, Growth rates, Invertebrates, Copper, Benthic fauna.
Identifiers: *Lake Trawsfynydd.

Lake Trawsfynydd, a man made freshwater oligotrophic lake in the mountains of North Wales, is used as a cooling pond for the nuclear power station built on the lake shore. The distribution of the benthos and the life cycles of the temporary insect population in relation to the heated effluent were determined. The number of animals was found to increase as the sampling station became further removed from effluent point. At the end of the channel, where there is a reasonable number of animals, 75 percent of the population is Chironomus anthracinus, with Procladius choreus

making up 15 percent. The possibility that the raised temperature might have accelerated the growth rate and caused disruption of insect life-cycles is discussed. From the data it is concluded that the general advancement of the life cycles is not harmful. It appears that lack of animals in the effluent channel is related to some noxious substance present in the mud. Analysis of the muds demonstrated the presence of copper and zinc in large quantities. The condenser tubes, of admiralty brass are a very likely source of copper, but the analysis of the inflowing stream adjacent to the effluent point has identified a further source of copper. (Upadhyaya-Vanderbilt)
W72-10812

THE PLANKTON OF LAKE TRAWSFYNYDD,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.

J. W. Whitehouse, and S. Luff.

In: Symposium on Freshwater Biology and Electrical Power Generation, April 22, 1971, Part 2, p 131-152, 14 fig, 4 tab, 18 ref.

Descriptors: *Zooplankton, *Phytoplankton, *Heated water, Cooling water, Temperature, Water level fluctuations, Diatoms, Distribution, Life cycles, *Thermal pollution.

Identifiers: *Lake Trawsfynydd, Cyclops abyssorum.

A detailed study of Cyclops abyssorum sars and a general study of the phytoplankton in the warm and cold parts of Lake Trawsfynydd were made. The lake is shallow, with a mean depth of 5.2 m, mean pH 6.8, conductivity less than 50 micromhos and has highly colored water stained with humic material and suspended peat particles. Phytoplankton samples were collected using 125 cc medical flat bottles and preserved with Lugol's iodine. The results of the field work show that the total phytoplankton population is evenly distributed throughout the lake and that there are no changes which may be attributed to the warming of the water. The phytoplankton was composed mainly of diatoms of which Asterionella formosa and Tabellaria flocculosa v. asterionelloides were numerically the most important. The dominant zooplankton species was Bosmina obtusirostris. The general timing of the life cycle of Cyclops abyssorum was similar in both warm and cold parts of the lake. (Upadhyaya-Vanderbilt)
W72-10813

THE EFFECTS OF TEMPERATURE AND DISSOLVED OXYGEN CONCENTRATION ON REPRODUCTION IN LIMNODRILUS HOFFMEISTERI (CLAPAREDE) AND TUBIFEX TUBIFEX (MULLER) (OLIGOCHAETA, TUBIFICIDAE),
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.

R. J. Aston.

In: Symposium on Freshwater Biology and Electrical Power Generation, April 22, 1971, Part 2, p 161-175, 7 fig, 2 tab, 15 ref.

Descriptors: *Water temperature, *Dissolved oxygen, *Tubificids, Heated water, Reproduction, Cooling water, Growth rates, *Thermal pollution, Water pollution effects.
Identifiers: Cocoons.

Tubificids are one of the most ubiquitous groups of micro-invertebrates present in rivers used by power stations for cooling water. Under experimental conditions, Limnodrilus hoffmeisteri increased its rate of embryo production with increase in temperature from 5 C to 25 C, but Tubifex tubifex maintained a relatively constant rate of embryo production from 10 to 25 C. L. hoffmeisteri was able to maintain a fairly constant rate of embryo production over a wide range of dissolved oxygen concentrations, down to about 2 ppm. The results were in agreement with Boltov-

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skoi who recorded that in the warmed part of the lake, *L. hoffmeisteri* started to reproduce three weeks earlier, produced one more generation and was generally more abundant, than in unheated regions. Prolonged exposure to anaerobic conditions or very low oxygen concentrations might lead to a reduction in the rate of cocoon production and eventually to a reduction in the density of the warm population, in spite of the various adaptations to life at low oxygen concentrations. (Upadhyaya-Vanderbilt)
W72-10814

COPEPOD DEVELOPMENT; LABORATORY OBSERVATIONS ON CYCLOPS ABYSSORUM SARS,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
B. G. Lewis.

In: Symposium on Freshwater Biology and Electrical Power Generation, April 22, 1971, Part 2, p 187-208, 17 fig, 2 ref. CERL Report RD/L/M312.

Descriptors: *Heated water, *Electric powerplants, *Zooplankton, Copepods, Laboratory tests, Growth rates, Fecundity, Temperature, Density, Population, *Thermal pollution.

Laboratory studies of drastic and subtle effects of elevation of water temperature by power station discharges were run on zooplankton (*Cyclops abyssorum*). With diets of *Euglena* and/or *Artemia*, female size and fecundity were determined for different population densities of Cyclops. The development time increased with increase in density. The mean number of clutches per female and of eggs per clutch increased with increasing density. In tests with eggs grown at different temperatures between 5°C and 25°C, the development rate of Cyclops increased with increase in temperature, but the effect of temperature diminished as development proceeded. Individuals transferred to a different temperature did not adopt the expected rate of development for the new temperature. Those individuals transferred to a higher temperature adopted a faster rate than expected, and those transferred to a lower temperature adopted a relatively slower rate than expected. These results indicate that more than one development rate is possible at any one constant temperature, and may indicate that the transferred animals changed their development rate to meet a new completion date. (Eagle-Vanderbilt)
W72-10815

THE EFFECTS OF TEMPERATURE AND DIET ON ASPECTS OF THE PHYSIOLOGY OF THE RAINBOW TROUT - SALMO GAIRDNERII,
Nottingham Univ. (England). Dept. of Zoology.
A. Aitken.

In: Symposium on Freshwater Biology and Electrical Power Generation, April 22, 1971, Part 2, p 177-185, 5 fig, 3 ref.

Descriptors: *Rainbow trout, *Temperature, Metabolism, Ammonia, Heated water, *Fish diets, *Growth rates, Animal physiology, *Thermal pollution.

Identifiers: Low fat diet, High fat diet, Acclimation, Oxygen consumption, *Salmo gairdnerii.

Earlier experiments showed that on a low fat diet the specific growth rate of rainbow trout decreased when the temperature was raised from 12 to 16°C, while the same increase in temperature on a high fat diet resulted in an increase in the specific growth rate. A change from a low fat to a high fat diet, the temperature being held constant at 12°C, caused a fall in ammonia excretion which continued over several weeks while the high fat diet was being fed to the fish. At the same time the specific growth rate was considerably increased. It appears that fat was more available to the fish at the higher temperature, and that fat replaced protein as a calorie source when the dietary fat was sufficient. This was indicated by the decrease

in ammonia output and increase in specific growth rate. At various levels of activity, fish on the high fat diet have a lower oxygen consumption than those on the low fat diet. This might be explained by the fact that 4.686 Kcal of energy are obtained from 1 liter of oxygen when fat is metabolized, compared with 4.485 Kcal when protein is metabolized. (Upadhyaya-Vanderbilt)
W72-10816

SOME ASPECTS OF TEMPERATURE TOLERANCE IN CHIRONOMUS RIPARIUS MEIGEN AND CHIRONOMUS DORSALIS MEIGEN,

Nottingham Univ. (England). Dept. of Zoology.

K. U. Clarke, and P. F. Credland.

In: Symposium on Freshwater Biology and Electrical Power Generation, Central Electricity Research Laboratories, Part Two, April 22, 1971, p 209-213, 4 ref.

Descriptors: *Temperature, *Photoperiodism, *Chromosomes, *Aquatic insects, Chironomids, Growth rates, *Thermal pollution, Water pollution effects.

Identifiers: Endocrine system, Chromosome puffing.

The effects of temperature and photoperiod on the endocrine system and chromosome puffing in *Chironomus* sp. were studied. At 24°C (with a constant photoperiod of 13 hours light and 11 hours dark) chromosomal puffing is maximal and the size of the puffs is also at their maximum. At 10°C the chromosomes show little puffing and these puffs are of very small size. At 5°C no puffing of the chromosomes occurs. At decreasing photoperiod with constant temperature of 24°C the amount of neurosecretion in the nervous system is more variable than at constant photoperiod. Puffing of the chromosomes is similar to that in constant photoperiod animals. At increasing photoperiod the amount of neurosecretion at the junction of the posterior lobes of the brain is greater than in other treatments. Giant nuclei are always present and more variation in degree of swelling of the chromosome puffs occurs than under any other treatment. It is concluded that temperature is dominant over photoperiod in influencing growth and development in these two species of *Chironomus*. Both increasing and decreasing photoperiod affect the amount of neurosecretion, its increase probably indicating either a greater rate of synthesis or a slower rate of release. (Eagle-Vanderbilt)
W72-10817

THERMAL EFFECTS - PROBLEMS, SOLUTIONS,

Electric Thermometer, Trinity, Inc., Bridgeport, Conn.

For primary bibliographic entry see Field 05G.

W72-10832

SECOND READER ON WATER QUALITY,

Texas Water Quality Board, Austin.

J. P. Teller.

Texas Water Quality Board, Austin, 1970. 10 p.

Descriptors: *Eutrophication, *Measurement, *Biochemical oxygen demand, *Water quality, Lakes, Alkalinity, Acidity, Dissolved oxygen, Dissolved solids, Suspended solids, Nutrients.

Identifiers: Assimilation.

Measurement and eutrophication are discussed. In the wastewater field only one unit is generally used, that being milligrams per liter. An interchangeable unit is parts per million. This unit is used to describe the concentration of those various constituents in which we are interested. The most frequently used test for describing water quality is Biochemical Oxygen Demand (BOD). This is a measure of how much oxygen will be needed to assimilate the organic waste present in a sample. BOD is expressed in milligrams per liter.

The dissolved oxygen (DO) test measures the amount of oxygen present in the water. The pH test measures the alkalinity or acidity of the water. The coliform test is run to determine what types of bacteria are present in a sample. Eutrophication is basically the aging process of surface waters in which the waters are enriched or fertilized by natural or waste-borne nutrients which stimulate the excessive growth of algae and aquatic weeds. Lakes with no outlets are more susceptible to this condition than others. The principle means of controlling eutrophication is by removal, diversions, or dilution of nutrients from its source. (Poertner) W72-10852

LIVESTOCK INDUSTRIES IN TEXAS AS RELATED TO WATER QUALITY, REPORT NUMBER ONE,

Texas Water Quality Board, Austin.

D. Pittman, and P. Harris.

Texas Water Quality Board, Austin, 1970. 30 p, 5 tab, 10 ref.

Descriptors: *Texas, *Water quality, *Livestock, *Farm wastes, *Waste treatment, *Poultry, Wastes, Solid wastes, Cattle, Hogs, Sheep, Waste disposal, Farm management.

Trends are discussed in animal populations in Texas, management techniques employed by animal producers, and characteristics of animal wastes and treatment methods used. In addition, typical and/or economical animal producing units in Texas are described, with an explanation of current practices used to control water pollution caused by animal wastes. A number of conclusions are made from the material presented. The numbers of beef cattle, sheep and poultry in Texas are increasing. There is a trend to confine animals and feed them for more efficient production. Characteristics of animal wastes are variable making it difficult to determine the pollutional effects of the wastes and to recommend adequate treatment. Biological and chemical changes often occur in wastes from confined feeding areas. Conventional domestic waste treatment systems are as yet not feasibly adaptable to animal wastes. Current animal waste management for controlling runoff from confined feeding areas include the use of diversion terraces, ditches and retention ponds with irrigation facilities for dewatering the ponds. (Poertner) W72-10854

AUTOTROPHIC AND HETEROTROPHIC NITRIFICATION IN AQUATIC SYSTEMS (LA NITRIFICATION AUTOTROPE ET HETEROTROPE DANS LES ECOSYSTEMES AQUATIQUES),

Station d'Hydrobiologie Continentale, Biarritz (France).

M. Laurent.

Annales de L'institut Pasteur, Vol. 121, p 795-810, 1971. 5 fig, 5 tab, 30 ref.

Descriptors: *Nitrification, *Nitrogen fixation, Ammonia, Nitrates, Nitrites, Nitrogen cycle, Aerobic bacteria, Anaerobic bacteria, Oxygen, Temperature, Mud.

Identifiers: *Arthrobacter, *Autotrophic bacteria, *Heterotrophic bacteria, Hydroxylamine.

Some of the steps involved in the nitrification process in water and in mud are elucidated. Under aquatic conditions, e.g. in rivers, ponds and lakes, nitrification from ammonia occurs naturally in mud through the action of autotrophic and heterotrophic bacteria growing in micro-aerophilic conditions or by the sole action of heterotrophs in aerobic conditions. In the presence of strongly reducing muds it may be presumed that nitrification is absent. (LeGore-Washington)
W72-10858

MAIN DEMOGRAPHIC FEATURES OBSERVED ON 50 FRENCH TROUT RIVERS. INFLUENCE

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OF SLOPE AND CALCIUM. (PRINCIPAUX CARACTÈRES DEMOGRAPHIQUES OBSERVÉS SUR 50 RIVIÈRES A TRUITES FRANCAISES. INFLUENCE DE LA PENTE ET DU CALCIUM),
Station d'Hydrobiologie Continentale, Biarritz (France).
R. Cunat.
Annales d'Hydrobiologie, Vol 2, No 2, p 187-207, 1971. 10 fig, 3 tab, 16 ref.

Descriptors: Rivers, *River systems, Water types, *Trout, Classification, Aquatic habitats, River forecasting, River beds, River flow, Biological communities, *Calcium, *Slopes.
Identifiers: *Demographic river analysis, *River characterization, *France.

The demographic analysis is a simple method for trout rivers studies. It includes three parts: environment description, situation and dynamics of fish populations, comprehensive diagnosis and directions for management. An example is given. Sixty-three demographic diagnoses carried out in four districts of France are taken into account. A statistical study of the main demographic parameters is done with 53 of these diagnoses. Correlations with the following variables are studied: slope of the river (rectified according to width), and calcium content of the water, expressed by indices. Results of the analyses are presented for trout species. (LeGore-Washington)
W72-10859

MUTUAL RELATIONSHIPS OF MICROORGANISMS IN ILAWA LAKES WATERS,
Wyższa Szkoła Rolnicza, Olsztyn-Kortowa (Poland).

S. Niewolak, and I. Zmysłowska.
Polskie Archiwum Hydrobiologii, Vol 18, No 3, p 265-274, 1971. 4 fig, 4 tab, 18 ref.

Descriptors: *Inhibition, *Aquatic bacteria, Seasonal, Biorhythms, Pseudomonas, Microorganisms, Seasonal, Lakes.
Identifiers: *Saprophytic bacteria, *Bacterial inhibition, Bacterial toxins, Seasonal variations, Bacillus, Aeromonas, Micrococcus, Alcaligenes, Autoantagonism, Flavobacterium, Corynebacterium, *Ilawa lakes, *Poland.

Among 166 investigated cultures of saprophytic bacteria isolated from waters of Ilawa lakes, 79% hindered the development of numerous water bacteria. Relatively the greatest number of antagonists was observed in winter, and the least in autumn. The most extensive antagonistic action was observed in spore-forming bacteria of the genus *Bacillus*; the least number of antagonists occurred among bacteria of the genera *Aeromonas*, *Alcaligenes*, and *Micrococcus*. The phenomenon of autoantagonism was observed in 9 strains of the genera *Pseudomonas*, *Flavobacterium*, *Micrococcus*, and *Bacillus*. Eleven strains of the genera *Aeromonas*, *Corynebacterium*, *Micrococcus* and *Bacillus* stimulated the development of various types of bacteria. (LeGore-Washington)
W72-10860

THE INFLUENCE OF LIVING AND DEAD CELLS OF CHLORELLA VULGARIS AND SCENEDESMUS OBliquus ON AQUATIC MICROORGANISMS,
Wyższa Szkoła Rolnicza, Olsztyn-Kortowa (Poland).
S. Niewolak.
Polskie Archiwum Hydrobiologii, Vol 18, No 1, p 43-54, 1971. 8 fig, 38 ref.

Descriptors: *Chlorella, *Scenedesmus, Algae, Microorganisms, Environmental effects, Growth rates, *E. coli*, Azotobacter, Pseudomonas, Water pollution effects.
Identifiers: *Microbial growth, Micrococcus, *Bacillus*, *Vibrio*, *Rhodotorula*, *Aeromonas*.

The study concerned the influence of living and dead cells of *Chlorella vulgaris* and *Scenedesmus obliquus* upon some species of saprophytic bacteria sampled randomly from among a few hundred species isolated from Ilawa lakes water. Four different patterns of behavior of microorganisms have been found in the presence of living and dead cells of these two algal species: (1) dying of microorganisms in living and dead cultures of algae (*Micrococcus ureae*); (2) dying of microorganisms in living cultures of algae and development in dead cultures of algae (*Bacillus myoides*, *Escherichia coli*, *Vibrio* sp.); (3) dying of microorganisms in living and dead cultures of algae in the initial period of joint cultivation and development in the later period (*Azotobacter* sp., *Pseudomonas fluorescens*, *Rhodotorula* sp.); (4) intensive development of microorganisms in killed cultures of algae and dying in living cultures in the initial period of joint cultivation, followed by development in the later period (*Aeromonas* sp.). (LeGore-Washington)
W72-10861

A METHOD TO EVALUATE THE EFFECTS OF WATER POLLUTANTS ON FISH RESPIRATION,
British Columbia Research Council, Vancouver. F. D. Schaumburg, T. E. Howard, and C. C. Walden.
Water Research, Vol 1, p 731-737, 1967. 5 fig, 3 ref.

Descriptors: *Water quality, *Pesticide toxicity, *DDT, *Pulp wastes, *Respiration, *Bioindicators, *Fish physiology, Water pollution, Water pollution effects, Pesticides, Insecticides, Salmonids, Bioassay, Water pollution sources, Toxicity, Aquatic environment.
Identifiers: *Coho salmon, *Oncorhynchus* spp.

A method is described for direct measurement of variation in the respiratory pattern of salmonids induced by exposure to low concentrations of DDT (5-350 micrograms/kg, TLm96 = 13 micrograms/kg) and kraft pulp mill effluent (0-40% by volume, TLm96 = 26% by volume). The procedure monitors changes in water pressure which occur within the buccal cavity during the passage of water over the gills. A direct relationship was demonstrated between the concentration of and exposure time to the toxicant and the frequency of coughing (reversal of water flow over the gills). With kraft pulp mill effluent, a direct relationship was also indicated for changes in the rate of respiration and the concentration of effluent. A significant increase in the rate of coughing occurred at concentrations of DDT and kraft mill effluent lower than those which cause death in static bioassay. (Svensson-Washington)
W72-10862

A QUANTITATIVE ASSAY OF THE MINIMUM CONCENTRATIONS OF KRAFT MILL EFFLUENTS WHICH AFFECT FISH RESPIRATION,
British Columbia Research Council, Vancouver. C. C. Walden, T. E. Howard, and G. C. Froud.
Water Research, Vol 4, p 61-68, 1970. 4 fig, 2 tab, 5 ref.

Descriptors: *Water quality, *Pulp wastes, *Rainbow trout, *Respiration, *Fish physiology, Water pollution, Salmonids, Bioassay, Water pollution sources, Toxicity, Water pollution effects, Bioindicators, Aquatic environment.
Identifiers: *Coho salmon, *Oncorhynchus* spp., *Salmo* spp.

Procedural variables, such as water temperature and water velocity, in the buccal cavity technique for measuring the cough response of fish to kraft mill effluents, have been examined. The quantitative procedure which was developed can measure the threshold concentration level at which effluents produce respiration abnormalities in fish. The elapsed time requirement for this assay is the

same as for an acute bioassay. Minimum response concentrations, for neutralized pulping and bleaching effluents from a typical modern kraft pulp mill, were 1.1 and 4.0% respectively. The nature of aberrations observed in the respiration of fish exposed separately to pulping and bleaching effluents was identical, indicating that these effluents may contain similar toxic principles. Cough response observations indicate that fish acclimate to sublethal concentrations of kraft effluents, the time required for acclimation being related directly to the effluent concentration. (Svensson-Washington)
W72-10863

EFFECTS OF METAL CATIONS AND OTHER CHEMICALS UPON THE IN VITRO ACTIVITY OF TWO ENZYMES IN THE BLOOD PLASMA OF THE WHITE SUCKER, CATOSTOMUS COMMERMORI (LACEPEDE),
National Water Quality Lab., Duluth, Minn. G. M. Christensen.
Chemical-Biological Interactions, Vol 4, p 351-361, 1971/72. 6 fig, 2 tab, 36 ref.

Descriptors: *Enzymes, *Fish physiology, *Metals, *Heavy metals, *Water chemistry, Biochemistry, Toxicity, Water pollution effects, Cations, Inorganic compounds, Chlorides, Aquatic environment, Inhibition.
Identifiers: *Transition metals, *Enzyme inhibition, *Metal salts, Glutamic oxaloacetic transaminase, Lactic dehydrogenase, White suckers, *Catostomus* spp., Blood plasma.

Relative changes in the activity of glutamic oxaloacetic transaminase (GOT, L-aspartate-2-oxoglutarate aminotransferase) and lactic dehydrogenase (LDH, L-lactate-NAD oxidoreductase) in blood plasma from white suckers were determined after incubation with 49 compounds, principally inorganic chlorides, at concentrations of the ions up to 2 mg/ml in the reaction mixture. A sequence of inhibitory effect was arranged for each enzyme. Dose-response curves were qualitatively similar for most of the chemicals. GOT was most sensitive to silver and mercury, and LDH to palladium and mercury. Both enzymes are highly inhibited by metals which are highly toxic to aquatic animals. Correlations were studied between the inhibitory effect and certain physicochemical properties of chemicals, the best being found between the inhibition of GOT and the equilibrium constants of metal sulfides. (Svensson-Washington)
W72-10866

EFFECTS OF SALINITY, TEMPERATURE, AND DISSOLVED OXYGEN ON EARLY DEVELOPMENT OF THE PACIFIC COD (GADUS MACROCEPHALUS),
Fisheries Research Board of Canada, Nanaimo (British Columbia). D. F. Alderdice, and C. R. Forrester.
Journal of the Fisheries Research Board of Canada, Vol 28, No 6, p 883-902, 1971. 14 fig, 8 tab, 43 ref.

Descriptors: *Salinity, *Water properties, *Water temperature, *Dissolved oxygen, *Fish eggs, Salinity tolerance, Biochemical oxygen demand, Incubation, Fish physiology, Fish populations, Hatching, Aquatic environment.
Identifiers: *Temperature tolerance, *Pacific cod, *Gadus spp., Fish distribution, Euryhaline, Euryoxic, Stenothermal.

Effects of various combinations of levels of salinity, temperature, and dissolved oxygen on incubation of Pacific cod eggs were investigated in the laboratory. Quantitative relationships were determined, by response surface analysis, between the environmental variables, and four criteria used to estimate success of egg development. Distribution and abundance of Pacific cod are reviewed in light of the experimental results. Temperature is suggested to be of major importance to successful egg

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development in the natural environment; the temperature range associated with reasonable egg viability and incubation success is estimated to extend from about 2.5 to 8.5 C. The distribution of cod in the spawning season appears associated with water temperatures between 2.5 and 8.5 C in Asian waters. Near the southern limit of cod distribution on the North American coast the following associations are suggested in relation to temperatures of the upper mixed layer of coastal waters in the spawning period: limit of commercial abundance, 9 C; extent of limited commercial landings, 10 C; limit of occurrence, 13.5 C. (Svensson-Washington)
W72-10868

COHERENT OPTICAL SPATIAL FILTERING OF DIATOMS IN WATER POLLUTION MONITORING,
Virginia Polytechnic Inst. and State Univ.,
Blacksburg.
J. Cairns, Jr., K. L. Dickson, G. R. Lanza, S. P.
Almeida, and D. Del Balzo.
Archiv der Mikrobiologie, Vol 83, p 141-146,
1972. 4 fig, 6 ref.

Descriptors: *Methodology, *Microscopy, *Analytical techniques, *Diatoms, *Instrumentation, *Fourier analysis, *Optical properties, Filters, Systematics, Sampling, Data collections.

Identifiers: Diatom identification, Optical filters.

One major disadvantage of existing aquatic biological assessment methodology is the time lag between data collection and its subsequent evaluation. Biological assessment methods generally demand extensive professional expertise and relatively long time periods for evaluation. Thus, biological assessment approaches directed toward automation and rapid evaluation similar to those already in use to monitor physical and chemical parameters can greatly aid in reducing data feedback time. Consequently, the use of Fourier transform coherent optical techniques in the pattern recognition of microscopic algae, i.e. diatoms, is described. The results of the construction of complex-valued filters for diatoms and their usefulness in algal identification are presented. Some general applications to water pollution monitoring and control are discussed. (LeGore-Washington)
W72-10869

A SYMPOSIUM ON THE BIOLOGICAL SIGNIFICANCE OF ESTUARIES.
Sport Fishing Inst., Washington, D.C.

Report, March 1971. 111 p, 53 fig, 9 tab, 76 ref. First day (February 13, 1970) of a Coordinated Two-day Conference on the Uses of Estuaries. NSF Grant No. H00070.

Descriptors: *Estuaries, Water resources development, Salinity, Sediments, Phytoplankton, Aquatic plants, Zooplankton, Benthos, *Shellfish, *Striped bass, White perch, Commercial fish, Sport fish, Crabs, Water pollution, Oysters, Clams, Water quality, Pulp and paper industry, Pulp wastes, Water pollution sources, Water fowl, Dredging, *Bays, *Estuarine environment, *Estuarine fisheries, Saline water-freshwater interfaces, Fish reproduction, Marsh plants, Water pollution effects, New York, Potomac River, Rivers, Columbia River, Washington, Water supply, Fisheries, Future planning (Projected), Industrial wastes, Invertebrates, Anadromous fish, Chesapeake Bay.

Identifiers: Life cycles, Port Angeles Harbor, Puget Sound, Raritan Bay, Shad, Croaker, Blue fish, Blue crab, Sacramento, *San Joaquin Estuary, Middle Atlantic states, Coos Bay, Grays Harbor, Pulp mills, Bellingham Bay, Anacortes Bay, Everett Bay, Kraft process, Susquehanna River, Patuxent River, Rappahannock River, York River, James River, Weakfish, Scups, Black sea bass, Summer flounder, King whiting, *Mnemecopsis*, *Beroe*, *Gammarus*, *Neomysis*, *Spartina*, *Cocconotus*, Macroinvertebrates.

Using the concept that an estuarine zone is an area of ecological transition between freshwater and salt water as well as an environmental system, the 1970 Sport Fishing Institute Symposium presented aspects of biological, chemical, and geological mechanisms along with present and projected legal and sociopolitical influences at work upon estuaries. Six contributors represented University Departments of Oceanography and Fisheries, Biological Laboratories, Research Institutes, and the U.S. Department of the Interior, Bureaus of Commercial Fisheries, Sport Fisheries and Wildlife. Topics were as follows: 'The Biology of the Estuary'; 'The Texas Water Plan and Its Effect on Estuaries'; 'Striped Bass and Water Development in the Sacramento-San Joaquin Estuary'; 'The Biological Effects of Estuaries on Shellfish of the Middle Atlantic'; 'The Effects of Pollution on Estuaries of the Northwest Pacific Coast'; and 'The Significance of an Estuary on the Biology of Aquatic Organisms of the Middle Atlantic Region'. (Mackan-Battelle)
W72-10870

AN ANNOTATED BIBLIOGRAPHY OF ATTEMPTS TO REAR THE LARVAE OF MARINE FISHES IN THE LABORATORY,

Scripps Institution of Oceanography, La Jolla, Calif.

R. C. May.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price \$0.35. NOAA Technical Report NMFS SSRF-632, August 1971. 24 p, 38 ref.

Descriptors: *Fish, *Larvae, *Bibliographies, Bioassay, Marine animals, Aquaria, *Water temperature, Foods, Food habits, Laboratory techniques, Herrings, Smelts, Killifishes, Sticklebacks, Drums, Sculpins, Mullets, Silversides, *Fish food organisms, *Fish diets.

Identifiers: Anchovies, Flyingfishes, Hakes, Tube-snouts, Bluefishes, Porgies, Wrasses, Weavers, Mackerels, Tunas, Gobies, Scorpionfishes, Rockfishes, Greenlings, Poachers, Alligatorfishes, Comberooth blennies, Pricklebacks, Flounders, Soles, Puffers, Anglers, Cod, Laboratory techniques.

This annotated bibliography covers 38 citations of literature from the period 1878 to 1969. All fish species studied in these attempts are listed in an appendix. The types of food used in the attempts are listed in a second appendix. An annotation with each entry in the bibliography provides information on the fish studied, foods used, type of container, water temperature, maximum time kept, maximum length reached by larvae, the survival rate, and additional remarks. (Mortland-Battelle)
W72-10873

GREAT LAKES ALGAE MONITORING PROGRAM, 1969.

Michigan Water Resources Commission, Lansing, Dept. of Natural Resources.

For primary bibliographic entry see Field 05A.
W72-10875

TOXICITY AND DISTRIBUTION OF AROCLOR 1254 IN THE PINK SHRIMP *PENAEUS DUORARUM*,

Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Lab.

D. R. Nimmo, R. R. Blackman, A. J. Wilson, Jr., and J. Forester.

Marine Biology, Vol 11, No 3, p 191-197, November 1971. 5 fig, 4 tab, 10 ref.

Descriptors: *Polychlorinated biphenyls, *Pink shrimp, *Pesticide toxicity, Crustaceans, Pesticide residues, Bioassay, Absorption, Estuaries, Water pollution effects, Shellfish, *Florida, Estuarine environment, Rivers, DDT, *Path of pollutants, Salinity, Bays.

Identifiers: *Aroclor 1254, *Penaeus duorarum*, Accumulation, Escambia River, Mugil cephalus,

Penaeus setiferus, *Penaeus aztecus*, Brown shrimp, White shrimp, PCB, *Escambia Bay, *Leiostomus xanthurus*, Atlantic croaker, *Microtugon undulatus*, Macroinvertebrates, Biological magnification.

The significance of the pollution of Escambia Bay (Florida) and its contiguous waters by the PCB, Aroclor 1254, was assessed by establishing toxicity levels, determining routes of entry, and investigating its movement and distribution in various tissues of shrimp under controlled laboratory conditions. Acute toxicity tests showed that Aroclor 1254 was about one tenth as toxic to juvenile pink shrimp (*Penaeus duorarum*) as DDT. In chronic flowing-water bioassays, a concentration of 0.94 ppb killed 51 percent of the juveniles within 15 days. The juveniles were more sensitive to the chemical than the adults; exposure to 3.5 ppb for 35 days resulted in 50 percent mortality in a group of adults. Measurements of pesticide uptake from water by adult pink shrimp and translocation to the hepatopancreas, whole body, and abdominal muscle revealed that accumulation was linear with time in the first two areas, with a plateau being reached in the muscle within two days. Shrimp obtained the contaminant from water and food and concentrated it to 510.0 ppm in the hepatopancreas. Field studies in Escambia Bay showed that salinity was a factor which regulated the amount of Aroclor in the body. The brown shrimp, *Penaeus aztecus*, from upper Escambia Bay, salinity 1.0 percent, had the highest residues (132.0 ppm in the hepatopancreas). The highest residue in the pink shrimp captured in Pensacola Bay was 15.0 ppm. (Holoman-Battelle)
W72-10876

EFFECTS OF DIELDRIN IN SEAWATER ON THE DEVELOPMENT OF TWO SPECIES OF CRAB LARVAE, *LEPTODIUS FLORIDANUS* AND *PANOPEUS HERBSTII*,

Duke Univ., Durham, N.C. Dept. of Zoology.

C. E. Epifanio.

Marine Biology, Vol 11, No 4, p 356-362, December 1971. 2 fig, 7 tab, 22 ref.

Descriptors: *Dieldrin, *Pesticide toxicity, Sea water, *Crabs, Organic pesticides, Toxicity, Gas chromatography, Crustaceans, *Larval growth stage, Data analysis, Bioassay, Solvents, Chlorinated hydrocarbon pesticides.

Identifiers: *Leptodius floridanus, *Panopeus herbstii, Macroinvertebrates, Data interpretation, Acetone, Polyethylene glycol.

Experiments were conducted to determine: (1) the effect of 1 ppb dieldrin in sea water on development of four larval stages of *Leptodius floridanus*, and (2) the effect of various concentrations (1, 5, 10, 50 ppb) of dieldrin on development of *Leptodius floridanus* and *Panopeus herbstii* from hatching to the first crab stage. The larvae were reared in finger bowls, 88 mm in diameter with 10 larvae per bowl. The various concentrations of pesticide were prepared by first dissolving the dieldrin in acetone or polyethylene glycol 400 and diluting with sea water. Preliminary tests were run to assure that the solvents were not toxic to the larvae. The larvae of neither species were able to complete their development at 10 ppb dieldrin or higher in sea water. Groups of *L. floridanus* larvae reared in 1 ppb dieldrin in sea water had a 15 to 27 percent higher mortality during development to the post-larval stage than the controls. The highest mortality occurred during the first zoeal stage. The survival of *L. floridanus* larvae was not affected by 0.5 ppb dieldrin in sea water. The survival of *P. herbstii* larvae to the first crab stage was not affected by 1 ppb dieldrin in sea water. (Snyder-Battelle)
W72-10877

NUMBER OF EGGS AND YOUNG PRODUCED BY ZEBRAFISHES (BRACHYDANIO RERIO, HAM-BUCH.) SPAWNING IN WATER CON-

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Effects of Pollution—Group 5C

TAINING SMALL AMOUNTS OF PHENYL-MERCURIC ACETATE,
Uppsala Univ. (Sweden). Inst. of Zoophysiology.
J. E. Kihlstrom, C. Lundberg, and L. Hultin.
Environmental Research, Vol. 4, No. 4, p 355-359,
October 1971. 1 fig, 2 tab, 22 ref.

Descriptors: *Fish eggs, *Fish reproduction,
*Spawning, Fish, Water pollution effects, Toxicity,
Bioassay, Analytical techniques, Mercury,
Heavy metals.
Identifiers: *Phenylmercuric acetate, *Zebrafishes, Brachydanio rerio, Organomercury compounds.

The number of eggs laid and their frequency of hatching have been studied in the zebrafish (Brachydanio rerio) before and after the addition of phenylmercuric acetate to water. The number of eggs laid decreased significantly in water containing 1 ng or more of phenylmercuric acetate per gram of water. A probit analysis showed that the median effective dose (ED₅₀) was 2.2 ng/g of water. The reproductive capacity of the animals, however, was diminished at even lower concentrations. The frequency of hatching was diminished in eggs spawned in water containing 0.2 and 1 ng phenylmercuric acetate per gram of water. (Holoman-Battelle)
W72-10879

PCB AND P,P'-DDE IN EGGS OF CORMORANTS, GULLS, AND DUCKS FROM THE BAY OF FUNDY, CANADA,
Fisheries Research Board of Canada, St. Andrews (New Brunswick) Biological Station.
For primary bibliographic entry see Field 05A.
W72-10882

RECENT DEVELOPMENTS IN THE MEASUREMENT OF THE RESPONSE OF PLANKTON AND PERiphyton TO CHANGES IN THEIR ENVIRONMENT,
National Environmental Research Center, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 05A.
W72-10883

THE EFFECTS OF TECHNICAL CHLORDANE ON ENERGY METABOLISM OF BACILLUS SUBTILLIS,
University Coll. of Wales, Aberystwyth. Dept. of Biochemistry; and University Coll. of Wales, Aberystwyth. Dept. of Agricultural Biochemistry. R. Widdus, P. W. Trudgill, and M. J. Maliszewski. Journal of General Microbiology, Vol. 69, No. 1, p 15-22, November 1971. 3 fig, 2 tab, 34 ref.

Descriptors: *Pesticide toxicity, *Chlorinated hydrocarbon pesticides, *Metabolism, Respiration, *Enzymes, Inhibition, Oxidation, *Toxicity.
Identifiers: *Chlordane, *Bacillus subtilis, Electron transport.

When crude membrane preparations from broth-grown *Bacillus subtilis* (ATCC 9372) were incubated with 20 ppm technical chlordane, inhibition of NADH oxidase reached 45 percent in only 3 min, and 75 percent after 1 h. Maximum inhibition was obtained at this concentration of chlordane. NADH: acceptor, oxireductase (EC 1.6.99.-) of membrane preparations was insensitive to 20 ppm chlordane. Disruption of the remainder of the electron-transport chain appeared to be general though more severe in the region between NADH dehydrogenase and cytochrome c. A generalized assay for ATPases revealed no sensitivity to chlordane over a concentration range 20 to 100 ppm and a pre-incubation period of 1 h. The inhibition of TCA cycle enzymes observed, subsequent to the incubation of high-speed supernatant fluid with 20 ppm chlordane, extended the range of chlordane-sensitive phenomena to enzymes other than those that are membrane bound. (See also W72-10885)
(Mackan-Battelle)
W72-10884

THE EFFECTS OF TECHNICAL CHLORDANE ON GROWTH AND ENERGY METABOLISM OF STREPTOCOCCUS FAECALIS AND MYCOBACTERIUM PHLEI: A COMPARISON WITH BACILLUS SUBTILLIS,
University Coll. of Wales, Aberystwyth. Dept. of Biochemistry; and University Coll. of Wales, Aberystwyth. Dept. of Agricultural Biochemistry. R. Widdus, P. W. Trudgill, and D. C. Turnell. Journal of General Microbiology, Vol. 69, No. 1, p 23-31, November 1971. 3 fig, 4 tab, 24 ref.

Descriptors: *Pesticides, *Chemical oxidation, Cultures, *Metabolism, Fermentation, Bioassay, Growth rates, Enzymes, Enteric bacteria, Pathogenic bacteria, *Chlorinated hydrocarbon pesticides, Pesticide toxicity, Incubation, Streptococcus.
Identifiers: *Streptococcus faecalis, *Bacillus subtilis, *Chlordane, *Mycobacterium phlei, *Phosphorylation, Electron transport, Culture media.

Extracts of *Mycobacterium phlei* were used to study the importance of oxidative phosphorylation as a chlordane-sensitive metabolic activity, and to study the effect of chlordane on the TCA cycle and electron transport system. Cultures of *Streptococcus faecalis* and *M. phlei* were aerobically incubated at 37°C under static conditions or on a shaker operating at 200 rev/min. Anaerobic conditions were achieved by passing oxygen-free nitrogen through the medium. After addition of chlordane, oxygen consumption, adenosine triphosphatase activity, protein content, and other factors were analyzed either by conventional methods or autoradiation. Results indicated that technical chlordane completely inhibited the growth of *M. phlei* and *Bacillus subtilis* and partially inhibited oxidation of NADH and oxidative phosphorylation at concentrations equal to or greater than the minimum levels required to completely inhibit growth. *S. faecalis* was relatively insensitive to technical chlordane. (See also W72-10884) (Snyder-Battelle)
W72-10885

PRELIMINARY INVESTIGATIONS OF PETROLEUM SPILLAGE, HAINES-FAIRBANKS MILITARY PIPELINE, ALASKA,
Cold Regions Research and Engineering Lab., Hanover, N.H. Earth Sciences Div. W. E. Rickard, and F. Deneneke. Army Cold Regions Research and Engineering Lab Special Report 170, April 1972. 23 p, 24 fig, 4 tab.

Descriptors: *Oil spills, *Pipelines, *Water pollution sources, *Alaska, *Cold regions, Environmental effects, Ecology, Vegetation regrowth, Oil industry.

The effect of various petroleum products on arctic and subarctic environments is described through past fuel spills along the Haines to Fairbanks military pipeline. Since the incorporation of the pipeline in 1956 there have been 40 reported ruptures in the 8-in.-diameter pipe that traverses 626 surface miles. In the spring of 1956 it was necessary to remove ice from the pipe at 26 locations. The ice resulted from water left in the line during hydrostatic testing. Portions of the line had JP-4 jet fuel in them at this time, and when the line was cut large amounts of fuel flowed out over the soil surface. Little new vegetation has grown in these areas. Currently vegetative growth is located in small drainage areas where sufficient leaching of the fuel has occurred. Considerable new growth has occurred in one area where fire had removed the overlying material prior to fuel spillage. Similar results are evidenced in more recent arctic diesel fuel spills resulting from bullet holes and corrosion. New vegetative growth is mostly restricted to drainage patterns subjected to sufficient leaching. (Woodard-USGS)
W72-10909

EFFECT OF PESTICIDES ON DEVELOPMENT AND QUANTITY OF PROGENY OF SOME CLADOCERA, (IN RUSSIAN),
Akademiya Nauk URSR, Kiev. Instytut Hydrobiologii. E. P. Shcherban'. Gidrobiol Zh. Vol 6, No 6, p 101-105. 1970. Illus.
Identifiers: Atrazine, Ceriodaphnia quadrangula, *Cladocera, *Daphnia magna*, Development, Diuron, Herbicides, *Moina macrocopa*, *Pesticides, Progeny, Quantity, *Scapholeberis mucronata*, *Water pollution effects.

Embryonal and postembryonal development was inhibited in *Scapholeberis mucronata* with diuron and atrazine in doses of 0.05-0.25 mg/l and 1 mg/l, respectively. Diuron inhibited development in both phases in *Moina macrocopa* and *Daphnia magna*. Atrazine affected the embryonal development of *Ceriodaphnia quadrangula*. The intensity of reproduction was disturbed to a greater degree than animal development. The period of maturing, the interval between broods, the number of broods and the number of young in each were affected. Atrazine was less poisonous than diuron and caused substantially less decrease in potential production. It had a stimulating effect on potential production in *M. macrocopa* compared to the control. Experiments with *S. mucronata* and diuron in concentrations of 0.025, 0.15, 0.1 and 0.05 mg/l showed that the breeding capacity decreased as the concentration increased. Atrazine and diuron affected most the productive capacities of *S. mucronata*.—Copyright 1972, Biological Abstracts, Inc.
W72-10923

POLLUTION OF THE MOJI-GUACU RIVER: I. PROBLEMS CAUSED BY THE BACTERIA SPAEROTILUS NATANS, (IN PORTUGUESE),
Estacao Experimental de Biologia e Piscicultura, Pirassununga (Brazil). For primary bibliographic entry see Field 05B.
W72-10938

MARINE MICROBIOLOGICAL STUDIES OF MANGROVE SWAMPS OF KILLAI BACKWATERS,
Tamil Nadu Government Fisheries Research Station, Porto Novo (India). V. Venkatesan, and V. D. Ramamurthy. J Oceanogr Soc Jap, Vol 27, No 2, p 51-55, 1971, Map.
Identifiers: *Aquatic microorganisms, Aeromonas, *Gallionella*, India, Killai backwaters, Leptothrix, *Mangrove swamps, Mollusks, Vibrio.

The bacterial populations of mangrove swamps of Killai backwaters (11 deg 21 min - 11 deg 29 min N, 79 deg 46 min - 79 deg 50 min E, South India) were studied during Aug. 1968 (pre monsoon period) and Dec. (post monsoon period). The presence of these groups such as agar digesters, algin digesters, cellulose digesters, sulfate reducers, etc., brings about transformation of organic matter in the mangrove swamps. The presence of denitrifiers in mangrove swamps and in association with the molluscs may bring about the precipitation of CaCO₃ by removing the acid radicals such as sulfate and nitrite, increasing alkalinity. The luminous bacteria such as *Vibrio* and *Aeromonas* and the iron bacteria like *Leptothrix* sp. and *Gallionella* sp. were isolated.—Copyright 1972, Biological Abstracts, Inc.
W72-10941

REGULAR FORMATION PATTERNS OF TREMATODES OF BENTHIC INVERTEBRATES IN THE RESERVOIRS OF THE DNEPER CASCADE (IN RUSSIAN),
For primary bibliographic entry see Field 02H.
W72-10942

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects of Pollution

ON THE PARASITOLOGICAL SITUATION IN THE POND FARMS ON THE CARPATHIAN DISTRICT, Zooveternarnyi Instytut, Lvov (USSR). V. M. Ivasik, N. J. Fedusak, and K. I. Maslennikova.

Z. Fisch Hilfswiss, Vol 18, No (3/4), p 299-306, 1970, English summary.

Identifiers: *Argulus foliaceus*, *Bothrioccephalus gowkongensis*, *Branchiomyces sanguinis*, Carp, "Carpathian", USSR, *Chilodonella cyprini*, *Dactylogyrus vastator*, Farms, *Ichthyophthirius multifiliis*, *Khwania sinensis*, "Parasites", "Ponds", "Fauna".

The parasitic fauna of trout, carp, Amur carp x carp hybrids, and the herbivorous fish from the trout and carp pond farms of the Carpathian district was investigated. Eight parasitic species were found with trout, 26 with carp, and 16 with the herbivorous fish. Due to some peculiarities of the climatic conditions and the water supply as well as to the introduction of the Amur carp x carp hybrids the parasite infestation of the fish in the ponds of the Carpathian foothills and in the Transcarpathian regions was considerably below that of other pond farms. The parasites of highest pathogenicity include *Ichthyophthirius multifiliis*, *Chilodonella cyprini*, *Dactylogyrus vastator*, *Khwania sinensis*, *Bothrioccephalus gowkongensis*, *Argulus foliaceus*, *Branchiomyces sanguinis*. Steps to control these parasites are indicated.—Copyright 1972, Biological Abstracts, Inc.

W72-10944

RADIOECOLOGY APPLIED TO THE PROTECTION OF MAN AND HIS ENVIRONMENT (SUMMARY).

European Communities, Luxembourg. Commission.

For primary bibliographic entry see Field 05B.

W72-10946

TRITIUM SECRETION INTO COW'S MILK AFTER ADMINISTRATION OF ORGANICALLY BOUND TRITIUM AND OF TRITIATED WATER,

Agricultural Univ., Wageningen (Netherlands); and Centre d'Etude de l'Energie Nucléaire, Mol (Belgium).

For primary bibliographic entry see Field 05B.

W72-10952

RADIOECOLOGY AND CHEMOECOLOGY IN THE SERVICE OF THE PROTECTION OF NATURE,

Institute of Biology of the Southern Seas, Sevastopol (USSR).

For primary bibliographic entry see Field 05B.

W72-10955

ZINC AND COBALT UPTAKE BY THE BROWN SEAWEED *FUCUS SPIRALIS* (L.).

Reactor Centrum Nederland, Petten.

For primary bibliographic entry see Field 05B.

W72-10957

THE EFFECTS OF SUBLETHAL AMOUNTS OF CADMIUM AND MERCURY ON THE METABOLISM OF ZINC-65 BY FRESHWATER FISH.

European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

For primary bibliographic entry see Field 05B.

W72-10960

PHYSIOLOGICAL EFFECT OF SUBLETHAL DOSES OF METALLIC POLLUTANTS AND DETERGENTS ON FISH IN SOFT WATER: MODIFICATION OF CALCIUM EXCHANGE, (EFFECT PHYSIOLOGIQUE DE DOSES SUBLÉTALES DE POLLUANTS MÉTALLIQUES ET DE DÉTERGENTS SUR LE POISSON

ION D'EAU DOUCE: MODIFICATION DU TAUX D'ECHANGE DE CALCIUM A PARTIR DE L'EAU), European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Centre. For primary bibliographic entry see Field 05B.

W72-10968

Descriptors: *Anadromous fish, *Fish diets, *Alaska, Fish populations, Sticklebacks, Sculpins, Salmon, Aquatic habitats, Sites, Nuclear explosions, Environmental effects, Ecology, Forecasting, Baseline studies, Dominant organisms.

Identifiers: Dolly Varden.

Changes in food habits with habitat (stream versus lake), fish size, time of day, season, and sexual development are described. Comparison is made with the threespine stickleback, Aleutian sculpin and silver salmon smolts feeding in the same area. (Bopp-ORNL)

W72-10983

UPTAKE OF CS-137 AND CO-60 BY MARINE FISH (PLEURONECTES PLATESSA L., CALIONYMUS LYRA L., ET TRACHINUS VIBERA CUV.), (OBSERVATIONS SUR LA CONTAMINATION EXPÉIMENTALE DE TROIS ESPECES DE POISSONS MARINS PLEURONECTES PLATESSA L., CALIONYMUS LYRA L., ET TRACHINUS VIBERA CUV., PAR LE CAESIUM 137 ET LE COBALT 60), Commissariat à l'Energie Atomique, Cherbourg (France). Centre de la Hague.

For primary bibliographic entry see Field 05B.

W72-10969

TRACE METALS IN (SURFACE) WATERS, (METALLSPUREN IM WASSER — IHRE HERKUNFT, WIRKUNG UND VERBREITUNG), Stadtwerke Wiesbaden A.G. (West Germany). Laboratori.

For primary bibliographic entry see Field 05A.

W72-10975

QUANTITATIVE CHARACTERISTICS OF THE MEANS OF PENETRATION OF SR-90 INTO THE BODIES OF GASTROPOD MOLLUSKS, V. M. B. Nyanishkene, and G. G. Polikarpov.

Available from NTIS as AEC-tr-7225, \$3.00 in paper copy, \$0.95 microfiche. Radiobiology, Vol. 10, No. 6, p. 198-202, 1970. 3 tab, 5 ref. Translation from Radiobiologia, Vol. 10, p. 928-930, 1970.

Descriptors: *Strontium radioisotopes, *Absorption, *Snails, Gastropods, Path of pollutants, Nuclear wastes, Water pollution effects, Food chains, Public health, Aquatic life, Aquatic algae, Calcium, Radioactivity effects.

Food-intake and absorption-from-water pathways of Sr-90 uptake were compared in about one-month experiments. Both the snails and their food organisms (*Elodea*) were kept in water containing 10 microCi/liter of Sr-90 and 50 mg/liter of Ca. Experiments were conducted in the spring, summer, and autumn periods under laboratory conditions in two repetitions and four variations. In variation I the snails were kept in water without Sr-90 and were fed *Elodea* that had accumulated Sr-90; in variation II they were kept in water with Sr-90 and were fed *Elodea* that had accumulated Sr-90; in variation III they were kept in water with Sr-90 and were fed *Elodea* that did not contain Sr-90; in variation IV they were kept in water with Sr-90 without feeding. Uptake from the water was one (for the flesh) and two (for the shell) orders of magnitude greater than from food. (Bopp-ORNL)

W72-10978

PROJECT RULISON - FINAL OPERATIONAL RADIODACTIVITY REPORT - PRODUCTION TESTS, Nevada Operations Office (AEC), Las Vegas.

For primary bibliographic entry see Field 05B.

W72-10981

FRESHWATER FOOD HABITS OF SALVELINUS MALMA (WALBAUM) ON AMCHITKA ISLAND, Utah State Univ., Logan. Dept. of Wildlife Resources.

J. F. Palmisano.

Available from NTIS as TID-25897, \$3.00 in paper copy, \$0.95 microfiche. M. S. Thesis, Report No. TID-25897, 1971. 76 p, 2 fig, 25 tab, 34 ref. AT (26-1)-171.

Descriptors: *Anadromous fish, *Fish diets, *Alaska, Fish populations, Sticklebacks, Sculpins, Salmon, Aquatic habitats, Sites, Nuclear explosions, Environmental effects, Ecology, Forecasting, Baseline studies, Dominant organisms.

Identifiers: Dolly Varden.

Changes in food habits with habitat (stream versus lake), fish size, time of day, season, and sexual development are described. Comparison is made with the threespine stickleback, Aleutian sculpin and silver salmon smolts feeding in the same area. (Bopp-ORNL)

W72-10983

EFFECTS OF TRITIATED WATER ON THE EMBRYONIC DEVELOPMENT OF THE THREE-SPINE STICKLEBACK, *GASTERosteus aculeatus linnaeus*, Washington Univ., Seattle. Fisheries Research Inst.

S. J. Walden.

Available from NTIS as NVO-269-12, \$3.00 in paper copy, \$0.95 microfiche. Report No. NVO-269-12, May 1971. 13 p, 2 fig, 1 tab, 10 ref.

Descriptors: *Tritium, *Absorption, *Hatching, *Sticklebacks, Radioactivity effects, Oxygen requirements, Carbon dioxide, Cytological studies, Radiosensitivity, Embryonic growth stage, Aquaria.

No morphological anomalies other than a reduction in eye diameter were observed by hatching in lake water containing 2 miliCi/ml of tritiated water. Modification of the apparatus may be required for hatching a species less tolerant to low oxygen levels and high carbon dioxide. (Bopp-ORNL)

W72-10984

THE LOW-TEMPERATURE THRESHOLD FOR PINK SALMON EGGS IN RELATION TO A PROPOSED HYDROELECTRIC INSTALLATION, National Marine Fisheries Service, Auke Bay, Alaska. Auke Bay Fisheries Lab.

J. E. Bailey, and D. R. Evans.

US Fish Wildl Serv Fish Bull. Vol 69, No 3, p 587-593, 1971. Illus.

Identifiers: *Fish eggs, *Hydroelectric plants, *Oncorhynchus gorbuscha*, *Pink salmon, *Water temperature, Threshold, *Thermal pollution.

A proposed hydroelectric installation in southeastern Alaska would alter the seasonal pattern of stream temperatures and pose a threat to the natural production of pink salmon, *Oncorhynchus gorbuscha*. Analysis of experiments reported in the literature indicated that such an installation might lower stream temperatures below the threshold normal for the embryonic development of pink salmon. Experiments with pink salmon eggs incubated in refrigerated water showed that the eggs required initial temperatures above 4.5°C for normal embryonic development. An increase in mortality and in alevins with spinal deformities occurred when initial incubation temperatures were 4.5°C and lower; initial incubation at 2°C resulted in complete mortality. The proposed hydroelectric installation could result in temperatures as low as 4.5°C during spawning and initial incubation and could therefore be expected to cause an increase in mortality and the occurrence of deformed alevins. The low temperature would be followed by higher than normal winter incubation temperatures, which would have an unknown effect on the time of emergence of fry. A tunnel intake designed to draw water of a desirable temperature on demand would be required to protect salmon.—Copyright 1972, Biological Abstracts, Inc.

W72-10987

HYDROBIOLOGICAL NOTES IN SHIMOKITA PENINSULA, WITH SPECIAL REGARD TO

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Effects of Pollution—Group 5C

THE PLANKTON AND FISH DISTRIBUTION, (IN JAPANESE),

G. Yamamoto, T. Kashimura, S. Yoshida, and T. Sekino.

Jap J Ecol. Vol 19, No 6, p 246-254. 1969. Illus. English summary.

Identifiers: *Asellus, Distribution, Fish, Hyalotheca, *Hydrobiology, Insects, Japan, Larvae, Leptodictyum riparium, Macrocylops, Onchorhynchus masou, Pediastrium, Peninsulas, Plankton, Shimokita Peninsula (Japan), Tribolodon hakoneensis.*

A hydrobiological survey was carried out in 2 lakes in the Shimokita lake group, Lake Usori-ko and River Ohata in the Shimokita Peninsula at the northernmost part of Honshu, Japan. Lakes Akagawanauma, Tate-numa and Caldera Usori-ko are, respectively, eutrophic, dystrophic and acidotrophic. Their planktological characteristics correspond to their limnological designations. The phytoplankton are rich in Lakelet Akagawa-numa. In Lake Tate-numa the phyto- and zooplankton are poor not only quantitatively, but qualitatively, and some species of Chlorophyceae are characteristic to the moor. Pediastrium or Hyalotheca are dominant. Lake Usori-ko contains strong acid water due to sulphuric acid ion. The phytoplankton is scanty but zooplankton are abundant. The lake bottom is covered almost by the water moss Leptodictyum riparium, which plays an important role in basic biotic production. Only 1 fish species, Tribolodon hakoneensis, inhabits the lake and feeds on Asellus, insect larvae and Macrocylops. River Ohata shows no pollution. Twenty-four spp. and 2 ecotypes of fish inhabit the river. "Suginoko" an ecotype of the land-locked cherry salmon Onchorhynchus masou, is found throughout the year in the upper water area.—Copyright 1972, Biological Abstracts, Inc. W72-10989

POND-TROUTS AS CARRIERS OF CLOSTRIDIUM BOTULINUM AND CAUSE OF BOTULISM: I. CLOSTRIDIUM BOTULINUM TYPE E AND FISH-BOTULISM,

Tieraerztlichen Hochschule, Hanover (West Germany). Institut Tieraerztliche Lebensmittelkunde Fleischhygiene.

R. Bach, and G. Mueller-Prasuhn.

Arch Lebensmittel-Hyg. Vol 22, No 3, p 64-68. 1971.

Identifiers: **Botulism, Carriers, Clostridium botulinum, Culture, Fish, Fluorescence, Microscopy, Neutralization, Toxin, *Trout, *Public health.*

C. botulinum type E is ubiquitous and occurs especially in fish. The eating of such fish often leads to botulism in humans. C. botulinum type E shows easily altered growth behavior. The best methods of detection are the toxin-neutralization test, pure culture technique and immunofluorescence microscopy.—Copyright 1972, Biological Abstracts, Inc. (See also W72-10996 and W72-10997) W72-10995

POND-TROUTS AS CARRIERS OF CLOSTRIDIUM BOTULINUM AND CAUSE OF BOTULISM: 3. DETERMINATION OF CLOSTRIDIUM BOTULINUM TYPE E IN A POND PISCICULTURE WITH PROCESSING PLANT AS WELL AS IN FRESH AND SMOKED TROUTS OF DIFFERENT ORIGIN,

Tieraerztlichen Hochschule, Hanover (West Germany). Institut Tieraerztliche Lebensmittelkunde Fleischhygiene.

R. Bach, S. Wenzel, G. Mueller-Prasuhn, and H. Glässker.

Arch Lebensmittelhyg. Vol 22, No 5, p 107-112. 1971.

Identifiers: **Botulism, Carriers, Clostridium botulinum, Mud, Pond, Smoked fish, Temperature, *Trouts, Wrapping, *Public health.*

Altogether 366 samples of fresh and smoked trout, mud from fish ponds and samples of material were

examined for the occurrence of Clostridium botulinum. Type E was found in the mud, in the intestinal content of trouts and in smoked fillets of trout. Special microclimatic conditions (vacuum wrapping, temperatures) influence the growth and toxin formation of clostridia in smoked trout. Cl. botulinum type E grew under simultaneous toxin formation in fillets stored without vacuum wrapping at 5°C as well as in vacuum wrapped trout stored at 20°C. The influence of vacuum-foil and (or) temperature on the growth of this bacteria was not determined. Decay occurred quickly in all fillets at temperatures of 10°C, 20°C and 30°C. Total bacterial counts up to 10 to the 9th power occurred after 10 days and with a high degree of decay. Although the storage temperature of 5°C prolonged preservation, it could not prevent toxin formation by Cl. botulinum. The general decay and growth of Cl. botulinum type E did not always proceed in parallel.—Copyright 1972, Biological Abstracts, Inc. (See also W72-10995) W72-10996

POND TROUT AS CARRIERS OF CLOSTRIDIUM BOTULINUM AND CAUSE OF BOTULISM: 4. SOURCES OF CONTAMINATION AND PATHS OF CONTAMINATION IN FISHERIES AND PREPARATION INDUSTRY, POSSIBILITIES OF IMPROVING HYGIENE,

Tieraerztlichen Hochschule, Hanover (West Germany). Institut Tieraerztliche Lebensmittelkunde Fleischhygiene.

S. Wenzel, R. Bach, and G. Mueller-Prasuhn.

Arch Lebensmittelhyg. Vol 22, No 6, p 131-135. 1971.

Identifiers: **Botulism, Carriers, Clostridium botulinum, Contamination, Fisheries, Food, Hygiene, Industry, Preparation, Temperature, *Trout, *Public health, Smoked fish.*

Mud is a source of contamination for C. botulinum type E in trout pools. The route of contamination is probably from the mud through gills, skin and food to the muscles. Danger of contamination in the preparation of smoked trout fillets is extensively dependent on hygiene during preparation. Possibilities of improving this hygiene by abolishing sources of contamination (pool mud, water, fodder, water birds, dead animals, added fish), are discussed. The separation of preparation plants into pure and impure sections is necessary. Heating and packing are discussed. Smoke temperature should reach 80°C and be maintained for at least 10 min. Packed smoked fish should be transported and stored only at muscle temperatures up to +3°C.—Copyright 1972, Biological Abstracts, Inc. (See also W72-10995) W72-10997

EXPERIMENTAL DATA FOR ESTABLISHING THE CONTENT OF ALPHA, ALPHA, BETA-TRICHLOROPROPIONIC ACID AND OF ITS SODIUM SALT IN INLAND WATERS,

For primary bibliographic entry see Field 05A.

W72-11005

A SANITARY-TOXICOLOGICAL CHARACTERIZATION OF MELAMINE,

L. N. Gabrilovskaya, V. P. Laskina, and E. V. Faiziysh.

Fakt Vneshn Sredy Znachenie Zdorov'ya Naseleniya Resp Mezhdv Sh. Vol 2, p 115-120. 1970.

Identifiers: **Melamine, Toxicology, Water pollution effects, Water treatment, Potable water, *Organoleptic properties.*

A study was made of the effect of melamine (I; the amide of cyanuric acid) on the organoleptic properties of water, the natural purification of inland waters from contamination, and also on the animal body in acute, subacute, and chronic experiments. At 100 mg/kg I is inactive in the animal body: when administered it did not cause changes in any of the tests used. A concentration of more than 5 mg/liter of I may lead to a disturbance in the disinfection of

water for drinking and this is an epidemiological danger.—Copyright 1972, Biological Abstracts, Inc. W72-11006

LIMNOLOGICAL STATUS OF BIG SODA LAKE, NEVADA, OCTOBER 1970,

Nevada Univ., Las Vegas.

For primary bibliographic entry see Field 02H.

W72-11011

EFFECTS OF PULP MILL WATER ON PLANKTON AND PRODUCTIVITY,

West Virginia Univ., Morgantown. Dept. of Wildlife Management.

E. D. Michael, and J. W. Chambliss.

Tex J Sci. Vol 23, No 1, p 81-87. 1971.

Identifiers: **Crustacea, *Phytoplankton, Productivity, *Pulp wastes, *Rotifers, Water pollution effects.*

Effects of pulp mill effluents in phytoplankton, crustacean and rotifer populations are analyzed.—Copyright 1972, Biological Abstracts, Inc. W72-11012

THE PHYSIOLOGICAL ECOLOGY OF CYANIDIUM CALDARIUM,

Indiana Univ., Indianapolis. Dept. of Microbiology.

W. N. Doemel, and T. D. Brock.

J Gen Microbiol. Vol 67, No 1, p 17-32. 1971.

Identifiers: **Algae, Cyanidium caldarium, Ecology, Hot springs, Light, Photosynthesis, Physiology, Soils, Temperature, Hydrogen ion concentration, *Physiological ecology.*

The distribution and physiology of C. caldarium in its natural habitat in acidic hot springs and hot soils have been studied. This eucaryotic alga was the sole photosynthetic organism in habitats with pH less than 5 and temperatures greater than 40 degrees. The upper temperature limit of the alga was 55 degrees to 56 degrees and the optimum temperature for growth was 45 degrees. Temperature strains such as are found in blue-green algae of alkaline thermal habitats were not found for C. caldarium. In aquatic habitats the lower temperature limit was about 35 degrees to 36 degrees, the organism apparently being unable to compete at temperatures below this with other algae. In soils the alga was found at temperatures as low as 10 degrees, apparently because in terrestrial habitats competition with other algae was less significant. The pH range at which the alga has been found in nature was from 0.05 to 5.0 and growth in culture occurred over this whole range. The optimum pH for growth was between 2 and 3. In nature the alga was found in habitats of widely varying light intensity, up to 7000 ft-candles. The alga became adapted to reduced light intensity by increasing its photopigment concentrations. Photosynthesis in populations adapted to reduced light intensities was inhibited by high light intensities. The alga grew well on glucose in the dark, and the concentration of photosynthetic pigments was reduced. When such bleached cells were transferred to the light in the presence of glucose, pigments were not synthesized and heterotrophic growth continued; when glucose was omitted, pigment synthesis occurred and photosynthetic growth resumed. Glucose did not inhibit pigment synthesis when added to cells growing in the light.—Copyright 1972, Biological Abstracts, Inc. W72-11017

ENVIRONMENTAL HEALTH.

Academic Press: New York, N. Y.; London, England. 1971. P. P. Waldon, editor, 584 p, Pr. \$19.50.

Identifiers: *Book, *Environment, *Public health, Water quality, Water availability, Solid wastes, Waste disposal, Radioactivity.*

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects of Pollution

The interaction of man and his environment as it affects his physical and mental health and social well-being is discussed. Environmental conditions that foster the transmission of communicable diseases and exposure to toxic chemicals and hazardous physical conditions are reviewed. Conditions that stimulate efficient functioning, mental development and cultural satisfaction are also included. Topics include: insect and rodent-borne diseases; food preservation and contamination; the quality and quantity of water; sources of air pollution and its effects on health and vegetation; problems of solid-waste disposal; principles of radioactivity and the effects of radiation from natural and man-made sources; noise and temperature control in the occupational and residential environment; occupational hazards such as pneumoconiosis and dermatosis; and accident prevention. Instructions are provided for planning environmental health programs. They show how to define problems and formulate objectives, and demonstrate statistical and organizational techniques for achieving these objectives. The 12 contributions include extensive bibliographies.—Copyright 1972, Biological Abstracts, Inc.

W72-11018

INFECTIOUS PANCREATIC NECROSIS VIRUS: TEMPERATURE AND AGE FACTORS IN MORTALITY,
Mactaquac Fish Culture Station, Fredericton (New Brunswick).
C. Frantsi, and M. Savan.
J Wildl Dis. Vol 7, No 4, p 249-255. 1971. Illus.
Identifiers: Age, *Brook trout, Fisheries, Mortality, Necrosis, Temperature, *Viruses.

Infectious pancreatic necrosis virus was present in brook trout in 2 Ontario salmonid hatcheries but did not appear to cause high mortality. Experiments and field observations showed that a number of factors were responsible for the low mortality, in particular, low water temperatures during the age of highest susceptibility of the fry and a lack of, or low level of transmission of virus during these periods of cold water temperatures.—Copyright 1972, Biological Abstracts, Inc.

W72-11037

5D. Waste Treatment Processes

ECONOMICS OF WATER POLLUTION CONTROL FOR CATTLE FEEDLOT OPERATIONS,
Texas Tech Univ., Lubbock. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 05G.

W72-10536

HANDLING, STORAGE, AND TREATMENT OF DAIRY AND BEEF CATTLE WASTES IN CONFINED SYSTEMS,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
J. A. Moore, and D. W. Bates.
Paper No. 69-935, presented at the 1969 Winter Meeting of the American Society of Agricultural Engineers at Chicago, Illinois. 9 p, 6 fig, 8 ref.

Descriptors: *Farm wastes, *Storage tanks, *Disposal, Cattle, Treatment facilities, Confinement pens, Labor, Structural design, Slurries, Storage, Waste disposal, Waste treatment, Waste water treatment.
Identifiers: *Mechanization, *Land spreading, Gutter cleaners, Bedding, Slatted floors.

Increasingly complex systems for manure management of livestock operations have been developed. This complexity is mainly due to pressure from environmental concerns and the need to reduce labor requirements in these operations. The development of manure handling systems in dairy operations is reviewed. These systems range from hand labor systems to the more modern gutter cleaner where the system was completely mechanized to

reduce labor to a minimum with a corresponding increase in capital investments. These systems are all based on the liberal use of bedding to absorb the liquid from the wastes. The use of bedding involves the cost of obtaining the bedding and keeping it in place. Producers have begun to try to reduce these costs by reducing the use of bedding. Recently there has been an increase in the use of storage tanks under the floor and the use of slatted or partly slatted floors. If there was little or no bedding in the manure it would spread itself in and out of the building storage tank, eliminating the need for a mechanical distribution system. The need to reduce odors and solids will bring about more efficient treatment systems in the future. (Dorland-Iowa State)

W72-10537

BACKWASH INVESTIGATION AND A PROPOSED SIMPLE UNIFORMITY CONTROL,
Shreveport Dept. of Water and Sewerage, La.
For primary bibliographic entry see Field 05F.

W72-10539

MAGNESIUM CARBONATE FOR WATER TREATMENT,
Cincinnati Univ., Ohio.

R. N. Kimman.

Paper presented at the First Sanitary Engineering Seminar, Central Ohio Section, A.S.C.E., March 27, 1972. 11 p, 7 tab, 3 ref.

Descriptors: *Magnesium carbonate, Coagulation, Laboratory tests, Waste treatment, *Water treatment, *Waste water treatment, Surface waters, *Ohio.

Identifiers: *Drum processing wastewater.

MgCO₃ is compared with alum and lime as a coagulant for Ohio surface waters and variable drum processing wastewater. A pH titration curve using Ca(OH)₂ was run on four surface supplies. The lime dose to produce a pH of 11.3 was added to 500 ml samples and mixed at 100 rpm for 1 minute and 30 rpm for 20 minutes. Samples were settled for 20 minutes. 5 minutes time was generally efficient for the rapidly settling Mg(OH)₂ floc. Physical-chemical data are tabulated for different chemical doses on samples from the Ohio River, Licking River, Little Miami River, and Muddy Creek. Composite samples from steel drums were tested. These wastes include NaOH, detergents, sanitary sewage, oil, or anything that can be shipped by drum. The pH was 12.2 with a high COD value. A pH of 11.3 was attained by using HCl. Mixing was at 100 rpm for 3-5 minutes and 30 rpm for 20 minutes followed by settling for 10 minutes. Physical-chemical data are tabulated for coagulation of drum processing wastewater. MgCO₃, hydrolyzed with lime, effectively removes color, turbidity, COD, and other impurities. Flocculation and settling require less time than with alum and could alleviate sludge disposal problems. Economic, operational, plant instrumentation, and efficiency evaluations are being made on pilot and plant scale basis in Montgomery, Alabama. (Nardozzi-AWWA)

W72-10541

LIME SLUDGE AND ITS DISPOSAL,
Grand Rapids Dept. of Water, Mich.

H. T. Campion.

Journal of the American Water Works Association, Vol 26, No 4, p 488-494, April 1934.

Descriptors: *Sludge treatment, Drying, *Waste disposal, *Sludge disposal, Lime, Filters, Waste water treatment, *Michigan.

Identifiers: *Lime sludge, *Disposal methods, Rotary drier, Soil sweetener, Limestone scale, Pond reclamation, Calcining, *Grand River (Mich).

A build-up of sludge deposits resulted from intermittent dumping of lime sludge to the Grand River. Complaints on river pollution were received. Continuous sludge removal equipment for waste dilution

was expensive. 500 tons of sludge could be handled at the sewage treatment plant at extra cost. Plant modifications accompanied new sludge removal equipment. Disposal methods proposed included: transport to fill or ponding reclamation; partial or complete drying for use as soil sweetener; calcining and reuse; and use in paints, putty, wall board, etc. Sludge beds could reduce moisture to 50%. Automatic vacuum filtration was relatively inexpensive and could reduce moisture to 60%. Final drying could be accomplished in a rotary drier or Nichols Herreshoff furnace. Farm use of dried lime is possible. A laboratory calcining test was run. After 5 burnings and recycling of calcined lime, magnesium content increased. Lime purity was below local specifications. Some success was reported in using dried lime for plaster and insulating board manufacture. The final plan was to locally dry and bag sludge and compete with limestone now used. Demonstrations would be arranged and the product advertised. (Nardozzi-AWWA)

W72-10542

WATER PLANT SLUDGE DISPOSAL,
Dow Chemical Co., Midland, Mich.

R. S. Burd.

In: *A Study of Sludge Handling and Disposal*, Final Report to FWPCA, p 476-485, June 1966. 13 ref.

Descriptors: *Sludge treatment, Waste dilution, Lagoons, *Waste water treatment, Waste disposal, *Sludge disposal, Costs, Drying, Filtration.

Identifiers: *Purification wastes, *Softening waste, Alum recovery, Lime recovery, Sand drying beds, Vacuum filtration, Soil conditioning, Roadway base stabilization.

Treatment of water utility wastes has become important due to urbanization, unavailability of cheap land, and public awareness of pollution. Purification sludge is mostly inorganic with few odors. Softening wastes are principally calcium carbonate with small ferric, magnesium, and aluminum hydroxide precipitates. 2.5 lbs of dry sludge is produced per pound of commercial CaO. Solids concentrations vary from 5-33% with total volume 0.4-6% of total water treated. Dilution of waste into rivers produces turbidity and forms sludge banks. Lagoon capacities are affected by sludge solids concentrations, continuous or intermittent loading, supernatant decantation, and climate. Costs are given for pipeline transport to lagoons and for lime calcining processes. Sand drying beds and vacuum filters are useful. Dried sludge has been used for soil conditioning and roadway base stabilization. Alum recovery and lime recovery are suggested solutions to alleviating the magnitude of the sludge disposal problem. (Nardozzi-AWWA)

W72-10543

CONDITIONING OF WATER SOFTENING PRECIPITATES,
Springfield Dept of Water, Light and Power, Ill.
For primary bibliographic entry see Field 05F.

W72-10544

COST EVALUATION OF SAND BED DE-WATERING AND DRYING OF WASTEWATER SLUDGES,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.

J. H. Nebiker, and D. D. Adrain.

Filtration and Separation, May/June 1969. 4 p, 3 fig, 1 tab, 5 ref.

Descriptors: *Dewatering, *Drying, Filtration, Costs, *Sludge treatment, *Model studies, Waste water treatment.

Identifiers: *Sand beds, Formulae.

Approximately 72% of U.S. treatment plants use sand beds to provide filtration by gravity dewater-

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ing and drying by evaporation. Little research has been directed to optimize design. A rational formulation, or simulation, is presented to describe sand bed operation based both on dewatering and drying processes. Independent formulations are presented for dewatering and drying. Drying rates are dependent on moisture content. A sludge dewatering-drying model is provided with initial constraints on: initial solids content; specific resistance; coefficient of compressibility; drying intensity; depth of sand and supporting media; and quantity of sludge produced each day. Boundary conditions for method of operation were sludge depth applied and final moisture content desired. Cost criteria included: land; construction of sand beds; maintenance; periodic repairs; salvage land value; and application and removal of sludge. Cost data are developed for different conditions. Digital computer simulation is applied. A method to optimized application depth for sludge and predict costs by simulation is shown. (Nardozzi-AWWA) W72-10545

AN INVESTIGATION OF SLUDGE DEWATERING RATES, Massachusetts Univ., Amherst. Dept. of Civil Engineering.

J. H. Nebiker, T. G. Sanders, and D. D. Adrain. Journal Water Pollution Control Federation, Vol. 41, No. 8, Part 2, p R255-R266, August 1969. 11 fig, 2 tab, 13 ref.

Descriptors: *Sludge treatment, Drainage, Filtration, *Dewatering, Polymers, *Waste water treatment, Waste treatment.
Identifiers: *Gravity dewatering, Sludge depth, Specific resistance, Coefficient of compressibility, Filtrate viscosity, Initial solids content.

Sludge handling for primary and secondary treatment total 25-65% of total operating and capital costs. Emphasis should be placed on volume reduction before ultimate disposal. Parameter formulations and laboratory tests are needed for gravity dewatering. Details are provided on previous research. Possible parameters for gravity dewatering are: sludge depth, sludge permeability, final solids content, and character of supporting media. Formulations are presented for determining specific resistance and the coefficient of compressibility. Gravity dewatering, experimental apparatus and procedures are also described. Solids content, specific resistance, coefficient of compressibility, and uniformity coefficient data are tabulated for dewatering of mixed digested sludge on sand media. Standard divergence between theoretical and experimental values was < 5%. The theoretical formula, verified by experimentation, shows initial solids content, filtrate viscosity, depth, specific resistance, and coefficient of compressibility are important. Coarse media increase drainage rates but produce more turbid filtrates. Research to determine the influence of polymers on coefficient of compressibility is needed. This work should be applicable to water treatment wastes, industrial sludge, liquid manure, and benthic deposits. (Nardozzi-AWWA) W72-10546

HOW TO COOL STEAM-ELECTRIC POWER PLANTS,

Westinghouse Electric Corp., Pittsburgh, Pa. K. A. Oleson, and R. R. Boyle. Chemical Engineering Progress, Vol. 67, No. 7, p 70-76, July 1971, 17 fig, 4 tab, 3 ref.

Descriptors: *Thermal powerplants, *Heat balance, *Cooling water, Cooling towers, Costs, Evaporation, Efficiencies, Optimization, *Thermal pollution, Turbines.
Identifiers: Cooling lakes, Spray ponds.

Since the recent widespread adoption of Federal and State thermal pollution regulations, fewer new applications of conventional once-through condenser cooling systems are being installed. The advantages and disadvantages of once-through cool-

ing, cooling lakes, spray ponds, mechanical draft wet towers, natural draft wet towers and dry cooling towers are discussed. Once-through cooling systems have the lowest water use rate, with cooling towers and spray ponds near the same level, and cooling lakes at the highest rates, particularly for high wet bulb temperatures and low relative humidities. Considering a once-through cooling system as a reference, man-made cooling lakes would increase power production costs by 0.10 mills/K.W. hr, wet towers by 0.20 mills/K.W. hr, and dry cooling towers by 0.80 mills/K.W. hr. Even though several methods are used to optimize cooling system design specifications, only a detailed evaluation, considering all the capital and operating costs, can provide tremendous savings over the entire plant life. (Upadhyaya-Vanderbilt) W72-10563

LAGOON DISPOSAL OF WATER TREATMENT PLANT WASTES, Virginia Polytechnic Inst., Blacksburg. W. S. Medding.

Master's Thesis, 1969, 48 p, 4 fig, 7 tab, 12 ref.

Descriptors: *Water treatment, *Waste water treatment, Water pollution control, Water softening, Filtration, Oxidation lagoons, Design criteria, Biochemical oxygen demand, Turbidity, Sludge, Dewatering, Freezing.
Identifiers: *Backwash water, Suspended solids.

The increasing pollution load caused by direct discharge of water treatment plant wastes to receiving waters has stimulated interest in methods of treating these wastes. Tests were conducted at the Blacksburg-Christianburg-UPI Water Authority treatment plant to determine the efficiency of lagooning as a method of treating water treatment plant wastes. The lagoon used had a 1 million gallon capacity, had been in use for 11 years and was entirely filled with sludge. Tests showed that the lagoon effectively removed the majority of solids and produced an effluent suitable for re-use. BOD's of filter wash water and lagoon effluent were less than 5 mg/l and suspended solids concentrations were well below the 100 mg/l drinking water standards. In addition provision of shallow ponds allowed chemical sludges to freeze during winter conditions. The frozen sludges dewatered readily when thawed, reducing the volume for disposal by as much as 54%. Since lagoon effluents were normally suitable as raw water intakes, the lagoons were obviously capable of providing sufficient treatment for this particular type of waste. (Lowry-Texas) W72-10571

DIGESTION OF CONCENTRATED SLUDGE, Mississippi State Univ., State College. Dept. of Civil Engineering.

A. L. Champion. Master's Thesis, 1969, 86 p, 30 fig, 23 ref.

Descriptors: *Sludge treatment, *Digestion, *Waste water treatment, *Sludge digestion, Cost analysis, Volatility, Hydrogen ion concentration, Alkalinity, Analytical techniques, Retention, Sewage treatment.
Identifiers: *Solids concentration, Thickened sludge, Volatile solids.

The cost of digesters in a sewage treatment plant accounts for a large percentage of the total cost. One way of reducing this cost is to reduce the volume by increasing the concentration of the solids before they enter the digester. It has been hypothesized that if digester capacities are based on solids detention, the volumes required for the various sludges after thickening by present methods could be reduced as much as 64%. The objectives were to determine whether thickened domestic sludge could successfully be digested, and to evaluate an optimum solids concentration combined with an optimum digestion period that would produce a maximum volatile solids reduction. Observations of digesters were aimed at de-

tecting: (1) reduction in volatile matter added to the digester; (2) changes in pH, alkalinity, and volatile acids. In this study, sludges with solids concentrations of 5, 15, 25, and 35% were digested for loading periods of 30, 20, 15, and 10 days under constant temperatures of 90 to 95 deg. F. and continuous loading. The results showed that concentration has a definite effect upon digestion. The percentage of reduction in volatile matter decreased with increased concentration for all loadings. (Atkins-Texas) W72-10572

EFFECTS OF DEPTH OF WASTE STABILIZATION POND PERFORMANCE, Virginia Polytechnic Inst., Blacksburg. S. K. Anderson.

Master's Thesis, 1969, 75 p, 17 fig, 4 tab, 37 ref.

Descriptors: *Oxidation lagoons, *Waste water treatment, Algae, Photosynthesis, Depth, Thermocline, Climatic zones, Organic loading, Dissolved oxygen, Hydrogen ion concentration, Biochemical oxygen demand, Virginia.
Identifiers: *Suspended solids, Chase City (Va).

An 8 acre pond with a 3 ft depth and a 4 acre pond with a 6 ft depth were both loaded at 26 lb BOD/acre/day. Both ponds had been operating for two years on domestic wastes. Following a 45 day acclimation period, dissolved oxygen, temperature, and pH measurements were taken during 24 hour testing periods spaced at 2 week intervals for a 12 week period. BOD and suspended solids concentrations were also measured during each testing period. All pond levels contained dissolved oxygen at all times, with the deeper levels sometimes approaching the anaerobic state. Meanwhile, algal photosynthesis produced levels of 20 mg/l dissolved oxygen in the upper levels of the pond, while raising to pH above 10. Because of the frequent D.O. intrusions to the bottom level, methane fermentation was never established. The 6 ft pond depth in the deeper pond was sufficient to insure the establishment of a definite thermocline under existing climatic conditions in Virginia. Both the BOD and the suspended solids in the effluent present at concentrations of 30-40 ppm and 350 ppm respectively, were attributed to algae carried over in the effluent. In accordance with other recent studies and with theory, it was demonstrated that the deeper pond consistently produced a superior effluent in terms of both BOD and SS. (Lowry-Texas) W72-10573

PLANNING ANIMAL WASTE DISPOSAL SYSTEMS, Oregon State Univ., Corvallis. Cooperative Extension Service.

W. E. Matson.

Available from Cooperative Ext. Service, Oregon State University, Corvallis, 15 cents per copy. Oregon State University, Extension Circular 736, May 1971. 15 p, 15 fig, 4 tab.

Descriptors: Farm wastes, Regulation, Economics, Government agencies, Costs, Waste disposal, Legal aspects, Odor.

Problems of animal waste disposal will continue to be important factors in determining the location of large scale livestock enterprises. The producers and the public must realize animal waste handling, treatment, and disposal will cost something. No one treatment process or treatment system will be the solution for all animal production units. Sanitary engineers, agricultural engineers, economists, agronomists, animal husbandry people, and others will need to closely coordinate activities. Research and demonstration projects are badly needed. Many of the most obvious cases of pollution could have been prevented if the facilities were located in different areas. The economics of pollution and nuisance control in animal production may mean the difference between success and failure for the facility. Livestock operators are urged to keep in-

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formed of current regulatory policies of the Department of Environmental Quality. The Cooperative Extension Service can be helpful in planning expansion or dealing with waste disposal problems. (Bundy-Iowa State)
W72-10586

LIVESTOCK WASTE DISPOSAL AND WATER POLLUTION CONTROL,
Colorado State Univ., Fort Collins. Cooperative Extension Service.
For primary bibliographic entry see Field 05G.
W72-10587

SOME AEROBIC DECOMPOSITION PROPERTIES OF DAIRY-CATTLE MANURE,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
A. C. Dale, and D. L. Day.
Transactions of the American Society of Agricultural Engineers, Vol. 10, No. 4, p 546-548, 1967, 11 fig, 6 tab.

Descriptors: *Aerobic treatment, *Farm wastes, Biochemical oxygen demand, Cattle, Nitrogen, Phosphorus, Potassium, *Waste water treatment.
Identifiers: *Oxidation ditch, Volatile solids.

Additional information on aerobic decomposition properties of dairy-cattle manure would be helpful in designing Pasveer ditch dairy-production units. Information is needed on such characteristics as (a) percent of the volatile solids that can be broken down into carbon dioxide and water, (b) percent of solids that will be left in the ditch, and (c) BOD of the effluent. An experiment was conducted with the above factors in mind. The following conclusions were drawn: (a) the greater the concentration of dairy cattle wastes added to an aerobic digestion chamber, the lower the breakdown of the volatile solids; (b) approximately 50 percent of the volatile solids will be decomposed in a retention time of 18-1/2 weeks when the daily added wastes amount to 1/2 percent of the volume. (Manure contained 12.5 percent dry matter.) (c) Approximately 46 percent of the volatile solids will be decomposed in a retention time of 18-1/2 weeks when dairy cattle wastes are added at a rate of 1 percent of the volume of the aeration chamber daily. (d) The effluent, as indicated by the 5-day BOD, of all systems was reduced by more than 90 percent. (e) Salts are concentrated to some extent, but they did not appear to retard bacterial action for the concentrations obtained. (Bundy-Iowa State)
W72-10588

GUIDELINES TO LAND REQUIREMENTS FOR DISPOSAL OF LIQUID MANURE,
Guelph Univ. (Ontario).
L. R. Webber, T. H. Lane, and J. H. Nodwell.
In: Proceedings Eighth Industrial Water and Wastewater Conference, June 6-7, 1968, Lubbock, Texas. p 20-34, 1 fig, 4 tab, 19 ref.

Descriptors: *Farm wastes, Poultry, Confinement pens, Phosphorus, Potassium, Nitrogen, Crops, Landfills, Anaerobic digestion, Crop response, Rates of application, Fertilization.
Identifiers: *Stock piling, Incineration.

An intensification in the trend to raise livestock and poultry under high-density confinement housing has created problems in the disposal of liquid manures. Research is underway to produce guidelines that will assist producers in conforming to the pollution abatement laws in Ontario. The objectives are: (1) to set forth the accessible areas that producers must have for the utilization and disposal of liquid manure without causing water, air, or soil pollution; and (2) to test and to evaluate the guidelines by field and laboratory research and make, where necessary, revisions in the guidelines. Research has indicated that frequent and heavy applications of manure have resulted in a build-up in the soil of phosphorus and potassium without causing reductions in crop yield or con-

tributing to the pollution of water supplied. A nitrogen balance for Ontario conditions is presented to show that crops of continuous corn or grass could be expected to utilize up to 300 lb N (from manure) per acre. Application rates greater than 300 lbs N/acre could lead to a depression of crop yield and cause water contamination. (Bundy-Iowa State)
W72-10589

SWINE-WASTE MANAGEMENT,
Illinois Univ., Urbana. Dept. of Agricultural Engineering.
D. G. Jedele, and D. L. Day.
Paper No. 69-934, presented at the 1969 Winter Meeting of the American Society of Agricultural Engineers at Chicago, Illinois, 4 p.

Descriptors: *Farm wastes, *Legal aspects, *Design criteria, Hogs, Odor, Treatment facilities, Water pollution, Water quality, Design standards, Specifications, *Waste water treatment.
Identifiers: *Odor control, Stream pollution, Guidelines.

Producers of livestock are experiencing difficulties in the design of waste treatment facilities. These producers, motivated by a desire to avoid lawsuits or a desire to be good neighbors, are hard pressed to determine exactly how much treatment and what type of treatment is needed to prevent objectionable odors and streams and groundwater pollution. Most references and guidelines contain terms such as 'if you are not too close to your neighbors' and 'they sometimes release objectionable odors.' Producers want to know such things as how close is close and just how objectionable are the objectionable odors. Producers need to know their chances of being the object of a lawsuit or producing runoff that will result in pollution to water. Some type of guideline is needed to tell a producer what type of treatment he needs to satisfy his circumstances. (Dorland-Iowa State)
W72-10594

FARM ANIMAL WASTE DISPOSAL,
Ontario Water Resources Commission, Toronto. Div. of Research.
S. A. Black.
Water Management in Ontario Research. Publication No. 28, December 1967, 36 p, 1 fig, 9 tab, 44 ref.

Descriptors: *Farm wastes, *Confinement pens, Feed lots, Runoff, Nitrogen, Biochemical oxygen demand, Chemical oxygen demand, Fertilizer, Economics.

The theories and implications involved with the processing, treatment and disposal of farm animal wastes are described. Farm animal wastes have been contributing polluting materials to waterways for many years. The changing nature of farming in the very recent years, however, has increased considerably the pollution potential of farm animal wastes. Since this change is still in process, an intensive study into improving the methods and facilities for the disposal of farm animal wastes is well justified, as the methods of disposal available to the farmer may well control the location and magnitude of his enterprise in the future. (Bundy-Iowa State)
W72-10595

OVERALL PROBLEMS AND AN APPROACH TO DISPOSAL OF ANIMAL WASTE,
Cornell Univ., Ithaca, N.Y. Dept. of Poultry Science.

R. J. Young.
Proceedings available from University of Georgia, Athens, Ga., Extension Poultry Science Dept., for \$1.00. In: Proceedings Poultry Waste Management Seminar, Athens, Georgia, June 23, 1970, p 1-5.

Descriptors: *Farm wastes, *Dehydration, Forced drying, Oxidation lagoons, Odor, Runoff, Poultry, Economics, Waste disposal.

As agricultural specialization, intensity, and productivity increased, problems of disposing of liquid, solid, and gaseous by-products greatly intensified. In addition to the conflict of interest over the environmental quality, is the mammoth problem of disposal of large amounts of solid waste which is not only extremely offensive but has the potential to pollute both surface and subsurface waters. Investigations have been conducted on disposal systems, identification and control of odors, prevention of water pollution, removal of nutrients, reutilization of animal wastes either as fertilizers or feedstocks, and new methods of waste management which can become economically part of the total production system. As to odors, some masking agents were slightly effective, although the best control was to prevent the formation of the odor compound. The oxidation ditch as well as drying methods in treating animal wastes were also evaluated. (See W72-10599 thru W72-10603) (Bundy-Iowa State)
W72-10598

BIODEGRADATION OF POULTRY MANURE FROM CAGE LAYERS,
Agricultural Research Service, Beltsville, Md. Husbandry Research Div.
C. C. Calvert, N. O. Morgan, R. D. Martin, and H. L. Eby.
In: Proceedings Poultry Waste Management Seminar, Athens, Georgia, June 23, 1970, p 6-12, 3 tab, 2 ref.

Descriptors: Farm wastes, Waste disposal, Poultry, Odor, Biodegradation, Larvae, Nitrogen, Drying, Protein, Fertilizer.
Identifiers: *Pupae meal.

An attempt has been made to degrade poultry manure to a relatively dry and odorless product, and at the same time produce some return over the cost of the investment. The work utilizes the common house fly to process and biodegrade manure from caged laying hens. Two stages of the house fly cycle - the larvae and pupae - are used. The fresh manure was seeded with house fly eggs, approximately 3 eggs/gm., and the eggs were allowed to hatch and the larvae were allowed to tunnel and aerate the manure. The process results in deodorizing a very obnoxious product, reducing its moisture content and volume, and has produced byproducts in the form of high protein pupae meal and a potentially useful fertilizer and/or soil conditioner. (See also W72-10598)
W72-10599

PROCESSING PLANT SANITATION AND ITS RELATIONSHIP TO WASTE MANAGEMENT,
Cagle's, Inc., Atlanta, Ga.
J. K. Keim.

In: Proceedings Poultry Waste Management Seminar, Athens, Georgia, June 23, 1970, p 13-15.

Descriptors: *Farm wastes, Poultry, Biochemical oxygen demand, Sewers, Municipal wastes, *Food processing industry, Water pollution sources, Industrial wastes.
Identifiers: Processing plant sanitation.

In processing plant sanitation there can be no halfway measures. There is no substitute for cleanliness in a food preparation establishment. The problem has two main factors: the amount of pollutants in the effluent, and the amount of effluent itself. The blood during poultry processing creates a big problem. The two largest sources of blood are the bleeding alley and the contents of the vacuum lung tank. Some plants still have a continuous stream of water running over the floor while others permit it to accumulate and then at cleaning time push it into a gutter and wash it down to the separator. The majority of the blood handled in this way also ends up in the sewer, only a minor amount being sufficiently solid to fail to escape from the separator. If the plant is connected to a city sewer, the chances are very great that the charge is based on B.O.D. load. These charges

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would soon pay for equipment to reduce the loading. Relatively new cleaning systems utilize high pressure and small volume and make the cleaning operation more efficient. (See also W72-10598) (Bundy-Iowa State) W72-10600

WATER UTILIZATION IN PROCESSING PLANTS,

Agricultural Research Service, Athens, Ga. Animal Products Lab.

D. Hamm.

In: Proceedings Poultry Waste Management Seminar, Athens, Georgia, June 23, 1970, p 16-22, 2 tab.

Descriptors: *Farm wastes, Poultry, Biochemical oxygen demand, Bacteria, *Food processing industry, Water utilization.

Identifiers: *Poultry processing plant.

A poultry processing plant (PPP) today is a ravenous user of clean water. Water usage per bird processed more than doubled during the 8 year period from 1957 to 1965 — up from a 5 to 7 gallon average to a 12 to 15 gallon average. This means a total of 28 lbs of input or 36 lbs water per pound of edible product. Like all functioning biological systems, a PPP uses water to transport, disperse, and to regulate temperature. Parts and wastes are water flushed; water scalds the bird, washes it to disperse and transport wastes and debris; water cools it; and water cleans up the building and equipment. There are three general problem areas insofar as water is and from PPP's are concerned. The problems are: (1) how to cut down on volume; (2) how to reduce total waste loading; and (3) how to process the waste water before returning it to the environment. Research is needed to find ways to reduce the quantity required in poultry processing plants. (See also W72-10598) (Bundy-Iowa State) W72-10601

FEEDING PROBLEMS ARISING FROM THE USE OF POULTRY LITTER ON PASTURES,

GEORGIA Univ., Athens. School of Veterinary Medicine.

D. J. Williams.

In: Proceedings Poultry Waste Management Seminar, Athens, Georgia, June 23, 1970, p 23.

Descriptors: *Farm wastes, Poultry, Cattle, Fescues, Pastures, *Animal diseases, Fertilizer, Waste disposal.

Identifiers: *Fat necrosis, Dead fat.

Cattle grazing on tall fescue heavily fertilized with poultry house waste may be developing a condition which tentatively has been called 'fat necrosis' or 'dead fat,' among other things. Postmortem on cows showed portions of the abdomen area covered with very hard, chalky fat and in some instances this fat has completely closed the small intestines and surrounded kidneys, shutting off the urine process. Empirical evidence indicates that grain supplement 4-6 weeks prior to parturition prevents the development of this condition. (See also W72-10598) (Bundy-Iowa State) W72-10602

PROGRESS REPORT: PASTURE FERTILIZATION USING POULTRY LITTER,

Agricultural Research Service, Watkinsville, Ga. Soil and Water Conservation Research Div.

S. R. Wilkinson, W. A. Jackson, R. N. Dawson,

and D. J. Williams.

In: Proceedings Poultry Waste Management Seminar, Athens, Georgia, June 23, 1970, p 24-29, 6 ref.

Descriptors: *Farm wastes, *Waste disposal, Poultry, Litter, Fescues, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Fertility.

*Animal diseases, Fertilizer.

Identifiers: Nitrate poisoning, Grass tetany.

Growing chickens and using the litter to produce extra grass and beef has been profitable. This practice has transformed the North Georgia countryside from eroded red clay to lush green grass by enhancing soil fertility, conservation, and wise land use. However, in some pastures where rates of litter applications have been high, animal health problems such as nitrate poisoning, grass tetany, and fat necrosis have appeared. The objectives were to produce under controlled and recorded conditions a tall fescue pasture heavily fertilized with broiler litter for the purpose of studying cumulative effects of high rates of broiler litter fertilization on selected soil, plant, and animal parameters in a grazing ecosystem; including the development of potential animal health problems of nitrate poisoning, grass tetany and fat necrosis. The research has not yet been completed, but the trends indicate that each ton of broiler house litter supplies about 60 lbs. of N, 30 lbs. of K, 30 lbs. of Ca, 8 lbs. of Mg, and is an important source of Zn, as well as micronutrients. The application of 14 tons of broiler house litter over a 365 day period has made some significant changes in soil chemical properties. Broiler manured fescue grass was consistently higher in total N than inorganic fertilized fescue except during the spring. (See also W72-10598) (Bundy-Iowa State) W72-10603

TRAVEL OF POLLUTION-INDICATOR BACTERIA THROUGH THE MAGOTHY AQUIFER, LONG ISLAND, NEW YORK,

Geological Survey, Mineola, N.Y.

For primary bibliographic entry see Field 05B. W72-10735

MICROBIOLOGICAL ASPECTS OF GROUND-WATER RECHARGE-INJECTION OF PURIFIED CHLORINATED SEWAGE EFFLUENT,

Geological Survey, Menlo Park, Calif.

For primary bibliographic entry see Field 05B. W72-10736

DEVICE FOR DE-WATERING MUD, SLUDGE OR FIBRE SUSPENSIONS,

T. Glowacki.

U. S. Patent No. 3,533,510, 3 p, 5 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 879, No 2, p 467, October 13, 1970.

Descriptors: *Patents, *Sludges, *Mud, Fibers, *Pulp, *Dewatering, Waste treatment, Separation techniques, Pollution abatement, *Waste water treatment.

A feeder screw is mounted for rotation in a perforated drum. The feeder screw feeds the mass to be de-watered from an inlet opening to an annular outlet. A series of flaps are individually biased so as to open individually under the influence of the pressure from the de-watered pulp. (Sinha-OEIS) W72-10746

ACTIVATED SLUDGE INSTALLATION WITH CONCENTRICALLY ARRANGED CIRCULAR TANKS WITH ONE CIRCULAR TANK AN AERATING TANK AND RAPIDLY RUNNING BRIDGE,

J. Scipp, and A. Schreiber.

U. S. Patent No. 3,533,508, 4 p, 10 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 879, No 2, p 467, October 13, 1970.

Descriptors: *Patents, *Activated sludge, *Aeration, Waste treatment, Water pollution, Pollution abatement, *Waste water treatment.

This activated sludge installation differs from others in that a quickly revolving bridge is supplied simultaneously with compressed air for aeration and also with current for the supply of the driving motor of the bridge. It also has a special type of removable aeration device attached to the bridge, and sludge scrapers for the centered final sedimentation tank. The aeration device can be taken out or inserted quickly for repairs or examination. (Sinha-OEIS) W72-10747

tation tank. The aeration device can be taken out or inserted quickly for repairs or examination. (Sinha-OEIS) W72-10747

APPARATUS FOR COLLECTING AND CONTAINING OIL ON THE SURFACE OF WATER,

Water Pollution Controls, Inc. (assignee).

For primary bibliographic entry see Field 05G. W72-10750

METHOD OF TREATING SEWAGE,

FMC Corp., Princeton, N.J. (assignee).

L. D. Friedman.

U. S. Patent No. 3,530,067, 3 p, 4 tab, 1 ref; Official Gazette of the United States Patent Office, Vol 878, No 4, p 1027, September 22, 1970.

Descriptors: *Patents, *Sewage treatment, *Aeration, Pollution abatement, Water pollution, Water pollution treatment, *Organic matter, *Waste water treatment.

Identifiers: *Hydrogen peroxide.

This sewage treatment process consists of passing oxygen-containing gas through an aqueous waste material containing solid and soluble organic matter. The temperature is held at less than 100 degrees C and hydrogen peroxide is added either incrementally or continuously during aeration. The treated mixed liquor is withdrawn to a settling tank where the sludge can be settled in 15 to 30 minutes. (Sinha-OEIS) W72-10752

APPARATUS FOR ACTIVATED SLUDGE TREATMENT OF OXYGEN DEMANDING WASTES,

R. L. Fifer.

U. S. Patent No. 3,529,725, 2 p, 2 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 878, No 4, p 949, September 22, 1970.

Descriptors: *Patents, *Activated sludge, *Bacteria, *Aeration, Waste treatment, Water pollution treatment, *Waste water treatment, Pollution abatement, *Biochemical oxygen demand.

The aeration device includes an aeration chamber and a lid. Extending downward from the underside of the lid is a chute which divides the chamber into concentric aeration zones in communication with each other at their lower ends forming a single open zone. A raw sewage inlet opens into an aeration zone either within or beside the chute. Below the chute an air diffuser is adapted to inject air into each of the concentric aeration zones. (Sinha-OEIS) W72-10754

APPARATUS FOR THE TREATMENT OF WASTE WATER,

Waste Water Treatment Corp., New York. (assignee).

K. B. Ray.

U. S. Patent No. 3,528,549, 5 p, 7 fig, 2 ref; Official Gazette of the United States Patent Office, Vol. 878, No. 3, p. 657, September 15, 1970.

Descriptors: *Patents, Waste water, *Waste water treatment, Pollution abatement, *Biological treatment, *Industrial wastes, Water pollution, Water pollution treatment, Trickling filters, Filtration, *Chemical wastes, *Settling basins.

A vertically elongated tower structure has a lower section for settling solids from waste water and a superimposed upper section for biochemical treatment of the water. The lower section is divided by vertical partitions into a series of chambers for holding bodies of water extending nearly to the top of that lower section. The waste water to be treated is introduced into the first of the chambers and the treated water is discharged from near the top of the last of the chambers. The upper section

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contains a trickling filter medium. Water is withdrawn from an intermediate chamber of the series and distributed over the top of the filter medium for gravity flow downward on the latter. Air is admitted to the lower end of the upper section for passage upward in contact with the flow of water on the filter medium. (Sinha-OEIS)
WT2-10759

CHLORINE RESIDUAL CONTROLLING SYSTEM,
General Signal Corp. (assignee).
For primary bibliographic entry see Field 05F.
WT2-10760

ELECTROLYTIC SOFTENING OF WATER,
Nalco Chemical Co., Chicago, Ill. (assignee).

R. B. Thompson.
U. S. Patent No. 3,652,433, 4 p, 4 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 4, p. 1431, March 28, 1972.

Descriptors: *Patents, *Water softening, Dissolved solids, Calcium, Magnesium, *Electrolysis, *Waste water treatment.
Identifiers: *Deionization.

The electrolytic deionization of water is carried out in a system that includes a horizontally disposed container for the water, a pair of spaced electrodes and controlled outlets. A unidirectional current, capable of imposing a voltage differential of between a minimum of about 4 to 5 and preferably of about 10 to 15 volts, and a maximum of not over about 100 volts, and preferably not over 50 volts, is established between the electrodes. (Sinha-OEIS)
WT2-10761

REACTOR FILTER ASSEMBLY,

M. J. Berardi.
U. S. Patent No. 3,651,942, 3 p, 4 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 4, p. 1321, March 28, 1972.

Descriptors: *Patents, *Water purification, *Waste water treatment, *Pollution abatement, Water pollution, *Water pollution treatment, Separation techniques, Phosphate, Nutrients, Iron, Manganese, Dissolved gages, Turbidity, Aeration, Biochemical oxygen demand.

The reactor filter assembly consists of a four-stage system. The influent is first treated with conditioning chemicals and aerated for oxidation and for the removal of undesired gases. The liquid is then conducted to a velocity suspended flocculation bed into a solid retention stage. A further stage provides for the final cleansing of the filtered water. Backwash and sludge drainage are provided and may be automatically controlled. (Sinha-OEIS)
WT2-10763

WASTE COLLECTOR,
Lee Co., Westbrook, Conn. (assignee).

L. Lee, II.
U. S. Patent No. 3,651,607, 3 p, 2 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 4, p. 1236, March 28, 1972.

Descriptors: *Patents, *Industrial wastes, *Waste water treatment, *Pollution abatement, Water pollution, Water pollution treatment.

This waste collector is a self-contained recirculating unit establishing a gravity assisted waterfall. It provides a continuously wetted exposed surfaces of significantly increased area substantially coextensive with that of the U-shaped spillway for collection of debris. (Sinha-OEIS)
WT2-10764

METHOD AND APPARATUS FOR THE CONTINUOUS REGENERATION OF ION EXCHANGE RESINS,
Societe Generale d'Epuration et d'Assainissement, Paris (France). (assignee).

J. C. Burriat, and P. du Fort.
U. S. Patent No. 3,650,948, 5 p, 2 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 3, p. 1072, March 21, 1972.

Descriptors: *Patents, *Ion exchange, *Resins, Water purification, *Waste water treatment.

A method of regenerating ion exchange resins in a fluidized bed is described. It consists of loosening, actually regenerating and rinsing the regenerated ion exchange resins as a continuous process in a single enclosure, in superposed successive zones. (Sinha-OEIS)
WT2-10765

FILTRATION APPARATUS,
Industrial Filter and Pump Mfg. Co., Cicero, Ill. (assignee).

J. F. Zievers.
U. S. Patent No. 3,648,842, 4 p, 3 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 2, p. 567, March 14, 1972.

Descriptors: *Patents, *Filtration, Equipment, *Radioactive wastes, Filters, *Pollution abatement, Separation techniques, *Waste water treatment, Water pollution, Water pollution treatment.

A roll type filtering device includes a filter tank and a disposable, self-contained, filter cartridge removably mounted in the filter chamber. The cartridge contains rolls of sheet filter material connected to a take-up spool rotatably mounted in a perforated container. When the cartridge is placed in the tank, the take-up spool mates with a drive-shaft in the filter tank and may thus be rotated to unwind the outer layers of the filter material from the rolls onto the take-up spool. The entire cartridge can be removed by a remotely operated crane and placed in a sealable drum for ultimate disposal. (Sinha-OEIS)
WT2-10767

SEWAGE DISPOSAL,
Underwater Storage, Inc., Washington, D.C. (assignee).
For primary bibliographic entry see Field 05G.
WT2-10770

SALT WATER DISTILLATION AND CONDENSATION SYSTEM AND METHOD,
For primary bibliographic entry see Field 03A.
WT2-10774

REVERSE OSMOSIS-ION EXCHANGE WATER PURIFICATION,
Union Tank Car Co., Chicago, Ill. (assignee).

B. H. Kryzer.
U. S. Patent No. 3,526,320, 3 p, 1 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 878, No. 1, p. 90, September 1, 1970.

Descriptors: *Patents, Water treatment, *Water purification, *Reverse osmosis, *Semipermeable membranes, *Ion exchange, Resins, Membranes, *Wastewater treatment.

This invention provides a method for purifying water wherein the water is conducted through a semi-permeable membrane to remove the majority of the dissolved and undissolved impurities by reverse osmosis. A portion of the water is stored until needed. It may be conducted through an ion exchange resin to remove any remaining ionic impurities. (Sinha-OEIS)
WT2-10775

METHOD AND APPARATUS FOR SEPARATING IMMISCIBLE LIQUIDS,
For primary bibliographic entry see Field 05G.
WT2-10776

ADMINISTRATION, SYSTEMS ANALYSIS.
Cornell Univ., Ithaca, N. Y. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 05G.
WT2-10779

ANALYSIS OF WATER REUSE ALTERNATIVES IN AN INTEGRATED URBAN AND AGRICULTURAL AREA,
Water Research Lab, Utah State Univ., Logan.
A. B. Bishop, and D. W. Hendricks.
September, 1971, 37 p, 20 fig, 16 tab, 15 ref, 2 append. PRWG23-7.

Descriptors: *Water reuse, *Water resources development, *Water allocation (Policy), *Water management (Applied), *Water treatment, *Water requirements, *Water demand, *Water users, *Water shortage, *Water supply, Planning, Systems analysis, Mathematical models, Utah, Groundwater, Surface waters, Effluents, Desalination, Tertiary treatment.
Identifiers: Salt Lake City, Primary water supply, Secondary water supply, Supplementary supply sources.

In areas where the primary water supply is no longer sufficient to meet the diversion requirements of all users, secondary and supplemental sources become important, and water demands must be met by recycle-and-sequential-reuse from secondary supply vectors or development of supplementary supplies. A conceptual framework is formulated in which all system permutations and water dispositions can be explored in order to select the least costly water reuse alternatives. Presented is a reuse planning model for analyzing alternatives of sequential-and-recycle-reuse in an integrated urban and agricultural environment. To illustrate application of the model to an actual water reuse system, a case study of the Salt Lake City, Utah area is presented. The model functions to determine the optimal allocations from each supply category to each use destination at minimum cost; linear programming is used to estimate alternative treatment and transportation costs. Furthermore, the analysis projects increasing future demands against a constant water supply and cities types of treatments that could rehabilitate water for reuse to meet demands at least cost; and establishes a least cost allocation that incorporates required design capacities for treatment facilities and indicates times when they should be phased-in to the system. (Bell-Cornell)
WT2-10781

USE OF REACTOR COOLING WATER FROM NUCLEAR POWER PLANTS FOR IRRIGATION OF AGRICULTURAL CROPS,
Oregon State Univ., Corvallis. Water Resources Research Inst.

L. L. Boersma, E. W. R. Barlow, and K. A. Rykrost.
Available from the National Technical Information Service as PB-210 747, \$3.00 in paper copy, \$0.95 in microfiche. Oregon Water Resources Research Institute, Corvallis, Publication WRR-12, April 1972, 95 p, 31 fig, 54 tab, 104 ref. OWRR B-009-ORE (3).

Descriptors: Nuclear power plants, *Irrigation systems, Water treatment, Recycling, Heated water, Nuclear wastes, *Water reuse, *Crop response, Crop production, *Thermal pollution.
Identifiers: *Waste heat.

Field tests were conducted with heat applied to the soil through underground pipes and crops growing under controlled conditions. Results obtained during three growing seasons have been summarized. A considerable variation in the response between

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years can be observed. This variation is in large part due to differences in climatic conditions during the three growing seasons. The results do indicate that for the growing conditions which prevail in the Willamette Valley, a yield increase from 30 to 40% may be expected for most crops grown. (Buckley-Oregon State) W72-10807

RESEARCH ON DRY-TYPE COOLING TOWERS FOR THERMAL ELECTRIC GENERATION: PART II,

Beck (R. W.) and Associates, Denver, Colo.

J. P. Rossie, and E. A. Cecil.

Copy available from GPO Sup Doc as EP2.10:16/30 EES 11/70, \$1.00; microfiche from NTIS as PB-210 778, \$0.95. Environmental Protection Agency Water Pollution Control Research Series November 1970, 101 p, 10 tab. EPA Program 16130 EES 11/70.

Descriptors: *Cooling towers, *Thermal power plants, *Computer programs, Optimization, Dimensions, *Thermal pollution.

Identifiers: Natural-draft cooling tower, Flow chart.

The study of dry-type cooling towers was facilitated by the development of two computer programs to aid in the analysis of the large quantity of data. The two programs are described in detail and instructions for their operation is provided. The physical dimensions of a natural-draft cooling tower and its capital cost are evaluated by the program titled TOWSIZ. The economically optimum dry cooling system is determined by the program titled OPTDCT. Flow charts and program listings along with output samples are given. Programs were coded in Fortran IV. The computer used was a CDC 6400 in the time sharing system at United Computing Systems, Kansas City. (See also W72-04827) (Upadhyaya-Vanderbilt) W72-10810

COOLING POND TEMPERATURE VERSUS SIZE AND WATER LOSS,

Environmental Protection Agency, Pacific Northwest Water Lab., Corvallis, Oreg.

For primary bibliographic entry see Field 05G.

W72-10829

NUCLEAR WASTE HEAT TO TREAT MUNICIPAL SEWAGE.

Water and Wastes Engineering, p 46-48, November 1971, 2 fig, 1 tab.

Descriptors: *Heated water, *Waste water treatment, Nuclear powerplants, Flow rates, Design standards, Costs, Design criteria, Water treatment, *Thermal pollution.

A sewage treatment plant using waste heat from a proposed nuclear power plant and providing Rhode Island with pure drinking water; a warm water aquiculture, fishing, and swimming area; and enormous man-made recreation islands has been envisioned. Raw sewage from metropolitan Providence would be pumped to the proposed sewage system for primary, secondary and tertiary treatment. Heat has been incorporated to accelerate the removal of floatable and settleable solids in primary treatment, to utilize thermophilic bacteria, to accelerate the digestion rate in secondary treatment, and to remove enteric bacteria and chemical impurities in tertiary treatment. A 60 inch diameter pipeline was calculated to give the minimum head loss while providing reasonable velocity at minimum flow. A preliminary cost estimate indicates that the total project would cost approximately 74 million dollars, based on a 30 mgd sewage treatment plant. The details of the plant and the general layout of the complex are shown. (Upadhyaya-Vanderbilt) W72-10831

DEEP TUNNELS IN HARD ROCK.
Wisconsin Univ., Milwaukee. Coll. of Applied Science and Engineering.
For primary bibliographic entry see Field 05G.
W72-10834

THE ROLE OF STORAGE IN ECONOMICS OF SEWAGE TREATMENT PLANT DESIGN,

Baue Engineering, Inc., Chicago, Ill.

For primary bibliographic entry see Field 05G.

W72-10837

FIRST READER ON WATER QUALITY,

Texas Water Quality Board, Austin.

J. P. Teller.

Texas Water Quality Board, Austin, 1967. 19 p.

Descriptors: *Water quality, *Sewerage, *Waste treatment, Abatement, Aeration, Settling basins, Aerobic treatment, Anaerobic digestion, Chlorination, Trickling filters, Stabilization, Activated sludge.

Identifiers: Imhoff tank.

This pamphlet discusses, in brief, sewerage systems, both domestic and industrial, the more common problems associated with waste treatment, and a listing of the more significant definitions. The definitions deal with the different types of equipment and processes used in addition to defining the basic sewer system. Also covered in this publication are explanations and pictorial sketches of trickling filter, contact stabilization and activated sludge treatment processes. (Poertner) W72-10851

REGIONAL SEWERAGE SYSTEMS AND TREATMENT COSTS IN TEXAS,

Texas Water Quality Board, Austin.

N. W. Classen, B. G. Scalf, and J. B. Copeland, Jr. Public Works Magazine, April, 1970. 21 p, 9 fig, 3 ref.

Descriptors: *Costs, *Project planning, *Economics, *Regional development, *Sewerage, Abatement, Water quality, Advanced waste treatment, Texas, Cost comparisons, Maintenance costs, Operating costs, Economics of scale, Sewers.

Identifiers: Regional sewer system.

The greater water quality and economic benefits realized through implementation and operation of a regional sewerage system over that experienced by a smaller system are demonstrated. By using the regional plan the possibility of having to bypass raw or partially treated sewage is diminished. Additional savings are accrued through the consolidation of operational maintenance facilities, this being especially true concerning laboratory facility costs. The regional system approach to wastewater collection and treatment has been found to be a most efficient and effective way to handle this service. Higher quality effluent is produced while total cost per person decreases as the size and capacity of the facilities increase. Even greater significance is being attached to this method because of the fact that tertiary treatment facilities double the cost of a particular installation. Greater economies will be realized by the area-wide approach where advanced treatment is required to maintain acceptable water quality. An area-wide system must be justified on the basis of economic feasibility and must be shown to serve the best interest of the people and the water pollution control need of the particular area. The end result is the production of a higher quality effluent and a greater degree of pollution abatement at less cost per unit volume of wastewater collected and treated. (Poertner) W72-10853

A QUICK BIOCHEMICAL OXYGEN DEMAND TEST.

California Univ., Davis.

For primary bibliographic entry see Field 05A.

W72-10871

PROCEEDINGS OF FIRST MEETING ON ENVIRONMENTAL POLLUTION, 15-16 APRIL 1970, SPONSORED BY AMERICAN ORDNANCE ASSOCIATION.

Edgewood Arsenal, Md.

Available from the National Technical Information Service as AD-738 544, \$3.00 in paper copy, \$0.95 in microfiche. Special Publication EASP 100-78, February 1972. E. Engquist, compiler. 245 p, 34 fig, 3 tab.

Descriptors: Water pollution, Pollution, Water pollution sources, Water pollution control, *Water pollution treatment, *Industrial wastes, *Pulp and paper industry, Chemical industry, Commercial fishing, Food processing industry, Mining, Powerplants, Thermal pollution, Sewage treatment, Oil industry, Lumbering, Agricultural runoff, Chemical analysis, *Chemical wastes, Poisons, Gases, Enzymes, Ions, Chlorine, *Activated carbon, Chemical reactions, Chemical oxidation, Influent streams, Effluent streams, Chemical oxygen demand, Biochemical oxygen demand, Adsorption, Inorganic compounds.

Identifiers: Nerve gas, Hypochlorite, Sarin, Charcoal, Chemical removal, Total organic carbon Soluble organic carbon.

During the 1970 meeting on environmental pollution held at Edgewood Arsenal, reports were presented on Solid Waste Disposal, the Department of the Army Environmental Control Program, Atmospheric Pollution, and Water Pollution. Water pollution was treated in four reports as follows: (1) 'Industrial Pollution Control Technology Program', (2) 'Activated Carbon in Treating Industrial Wastes', (3) 'Activated Carbon in Pollution Control', and (4) 'Detection, Decontamination and Removal of Chemicals in Water'. The latter report considers military, chemical (organic) contamination to be basically the same as industrial pollution, in that assessment must be made of the problem area. The degree of pollution must be determined and a means must be found to destroy or remove the pollutants. Treatment of Sarin (GB), a nerve gas used as an example of toxics entering a water system, involves a colorimetric detection using an enzyme and an acetate reaction and subsequent decontamination by hydrolysis catalyzed by the hypochlorite ion. Chlorine dioxide is a good oxidizing agent for phenolic and tertiary amine pollutants and sodium sulfate is used to remove TNT ammunition plant wastes. (Mackan-Battelle) W72-10874

BEST COMBINATION OF WASTE TREATMENT AND SPATIALLY DISTRIBUTED DISCHARGE OF EFFLUENT,

Rutgers - The State Univ., New Brunswick, N.J.

Dept. of Chemical Engineering; and Rutgers - The State Univ., New Brunswick, N.J. Dept. of Biochemical Engineering.

A. K. Mendiratta, and B. Davidson.

Water Resources Research, Vol. 8, No. 3, p 565-585, June, 1972. 10 fig, 3 tab, 31 ref.

Descriptors: *Waste water treatment, *Water quality control, *Effluents, *Biochemical oxygen demand, *Dissolved oxygen, Distribution, Standards, River basins, Planning, Optimization, *Mathematical models, Systems analysis, Pipelines, Networks.

Identifiers: *Water quality management, Optimal control theory, Stream quality standard.

The optimal control theory based on Pontryagin's minimum principle has been applied to the problem of specifying the best combination of minimum percent BOD waste treatment and effluent distribution policies for a single plant on a specified polluted river segment. The analysis features a new dual water quality stream standard consisting of a minimum allowable DO concentration at every point in the river segment combined

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with a maximum allowable BOD concentration at a specified downstream point. The optimal BOD effluent distribution policies are compared with choice suboptimal effluent discharge patterns associated with best single point, best uniform, and best bang-bang injection policies. The inequality constraints, the nonlinearities in the system model, and the synthesis of the optimal controls were handled in a direct manner by using the Pontryagin control theory principle combined with gradient search and penalty function techniques. The results establish certain guidelines for increasing the assimilative capacity of a given river segment through judicious combinations of minimum percent BOD waste treatment and continuous BOD effluent distribution or dumping patterns associated with single plant effluents. Certain cost factors associated with the pipeline distributor network and treatment plant could be incorporated directly into the optimization algorithm. (Bell-Cor nell)
W72-10891

HOW SERIOUS IS THE PROBLEM,
Hazen and Sawyer, New York.
For primary bibliographic entry see Field 05F.
W72-10922

PONTIAC RECALCINING PLANT,
Jones and Henry, Toledo, Ohio.
For primary bibliographic entry see Field 05F.
W72-10924

PONTIAC RECALCINING PLANT, DISCUSSION,
Dorr Co., New York.
For primary bibliographic entry see Field 05F.
W72-10925

PONTIAC RECALCINING PLANT, DISCUSSION,
Combustion Engineering Inc., Chicago, Ill.
For primary bibliographic entry see Field 05F.
W72-10926

EXPERIENCES IN POLYMER APPLICATIONS TO SEVERAL SOLIDS-LIQUIDS SEPARATION PROCESSES,
Dow Chemical Co., Midland, Mich.

S. J. Mogelnicki.
In: Proceedings, Tenth Sanitary Engineering Conference, Waste Disposal from Water and Waste-water Treatment Processes, University of Illinois, Urbana, Feb 6-7, 1968, p 47-62. 9 fig, 24 tab.

Descriptors: *Polymers, *Dewatering, Industrial wastes, Sedimentation, Centrifugation, Flotation, Filtration, *Waste water treatment, *Flocculation, *Industrial wastes, *Sludge treatment, Solid wastes, Separation techniques.

Identifiers: *Primary flocculants, *Flocculant aids, *Filter aids, Clarification.

The early utility of polymers in the mining, metal, and paper industries is cited. Data are tabulated on the effectiveness of synthetic, organic, high molecular weight, water soluble polymers to separate solids in industry. The polymers depend on adsorption, charge neutralization, and interparticle bridging to agglomerate small colloidal suspensions into large colonies. Typical cationic polyelectrolytes, anionic, and nonionic polymer formulae are presented. Polymers function as primary flocculants, flocculant aids, filter aids, and sludge conditioning agents. Data are tabulated for polymer application in sedimentation, flotation, filtration, and centrifugation processes. Wastewater clarification with polymer addition is described for an aluminum industry effluent, steel mill flue dust, electroplating streams, tanner waste, steel mill scale, and raw sewage flocculation at an activated sludge and trickling filter plant. Flotation data are presented for brewery, vegetable oil processing, meat packing, waste activated sludge and petrole-

um refinery wastes. Data are presented for sand bed drying and vacuum filtration of textile industry, elutriated digested primary, and primary-secondary elutriated digested wastes. Centrifugation studies were conducted on chemical and sewage sludges. Polymer advantages include reduced handling and chemical storage, easily controlled dose levels, increased suspended solids capture, higher hydraulic capacity, and reduced costs. (Nardozzi-AWWARF)
W72-10927

DEWATERING BY LAGOONS AND DRYING BEDS, O'Brien and Gere, Syracuse, N.Y.

J. D. McWain.

In: Proceedings, Tenth Sanitary Engineering Conference, Waste Disposal from Water and Waste-water Treatment Processes, University of Illinois, Urbana, Feb 6-7, 1968, p 63-76. 10 fig, 4 tab.

Descriptors: *Lagoons, *Dewatering, Evaporation, *Sludge treatment, *Filtration, Drying, Water treatment, Waste water treatment, New York.

Identifiers: *Sand drying beds, *Asphalt-paved beds, Aerobic sludge, Water treatment plant sludge, Cake concentration.

Observations, analyses, and investigations are presented on drying bed dewatering of aerobically digested sewage sludge and lagoon and drying bed dewatering of upflow clarifier sludge from water treatment plants. Handling and disposal options for aerobic sludge include centrifugation, air flotation-vacuum filtration, and drying beds. Sand drying beds dewater sludge by draining and evaporation. Shallow loaded beds dewater rapidly with solids concentration times inversely proportional to initial bed depth. Evaporation was independent of bed depth. A homogeneous sludge concentration of 25% reduced volume by 85%. Dewatering on asphalt-paved beds produced a 20% sludge content of the initial volume. Clarification sludge from the Shoremont and Wolcott Plants (N.Y.) was tested for lagoon and drying bed dewatering. Core samples from the lagoons showed this method unable to produce a 20% sludge. Pilot testing was initiated. Temperature, relative humidity, sand size, drainage time, drying time, total dewatering time, and final filtrate suspended solids concentrations are tabulated. A 1% sludge required 100 hours to produce a 20% cake with a filtrate of 240 mg/l suspended solids. A bed loading of 0.784 pounds dry solids/sq ft was needed. A 1.0-mm effective grain size was unsatisfactory for sludge dewatering. (Nardozzi-AWWARF)

W72-10928

ACTION NOW IN FILTER PLANT WASTE-WATER TREATMENT,

Malcolm Pirnie, Inc., White Plains, N.Y.

For primary bibliographic entry see Field 05F.

W72-10929

WATER AND WASTEWATER TREATMENT PLANT SLUDGES,

Stilson (Alden E.) and Associates, Ltd., Columbus, Ohio.

For primary bibliographic entry see Field 05F.

W72-10930

ADVANCES IN THE CENTRIFUGAL DE-WATERING OF SLUDGES,

For primary bibliographic entry see Field 05F.

W72-10931

RECOVERY OF WATERWORKS SLUDGE,

Tabriz Water Supply (Iran).

For primary bibliographic entry see Field 05F.

W72-10932

VIRUS REMOVAL--WATER AND WASTE-WATER,

Tennessee Univ., Knoxville. Water Resources Research Center.

W. A. Drewry.

Available from the National Technical Information Service as PB-210 857, \$0.95 in microfiche. Tennessee Water Resources Research Center, Research Report No. 24, May 1972. 43 p, 5 fig, 9 tab, 35 ref. OWRR A-018-TENN (4).

Descriptors: *Viruses, *Water treatment, Bacteriophage, *Waste water treatment, Chemical precipitation, Chlorination, Adsorption, Ion exchange, Flocculation, Microorganisms, Activated carbon.

The effectiveness of several conventional water treatment processes that also are or can be used as wastewater treatment processes was investigated with regard to virus removal and/or inactivation. A single virus and a standard plaque assay procedure were used to provide a valid basis for determination of the relative effectiveness of the various treatment processes tested. The virus was the bacteriophage f2, the Zinder strain, specific to *Escherichia coli* (K12 Hfr D). Phase I covered flocculation studies using several different coagulants and coagulant aids. Phase II involved batch and column studies to determine the effectiveness of activated carbon and ion exchange resins for virus removal. In Phase III waters from three sites were collected to perform variable chlorine test series and variable test time series. The three sites were: David Ferry on the Little Tennessee River, Fort Loudoun Lake, and Loves Creek wastewater treatment plant in Knoxville. The effect of chlorine, in the variable chlorine test series, increases as the time interval increases and is directly related to the organic content of the water; hence, the effectiveness of break point chlorination is inversely proportional to the COD of the water. The variable chlorine test series indicates that free chlorine is an excellent viricide with almost immediate killing power; however, the need to maintain a combined chlorine residual was enforced as the viricidal ability of combined chlorine, though somewhat slower than free chlorine, is much more permanent. The practice of maintaining a free residual at some chlorine dose past the breakpoint tends to offer two advantages: (1) a high degree of virus inactivation at initial contact and (2) the maintenance of a combined residual insures a more permanent killing ability for the water on a much longer time span. There exists a relationship between time, chlorine residual, and virus kill for any specific water. These relationships were plotted in isometric for the three waters in an attempt to more fully grasp and understand of the relationship between free chlorine and combined chlorine with respect to contact time.

W72-10933

METHODS AND DEVELOPMENTS IN TREATMENT OF NUCLEAR POWERPLANT WASTES (METHODEN UND ENTWICKLUNGEN DER ABWASSERAUFBEREITUNG IN KERNKRAFTWERKEN),

Kraftwerk Union A.G., Erlangen (West Germany).

H. G. Heitmann, and A. Puthawala.

Vom Wasser Vol. 38, p 373-390 1971. 7 fig, 2 tab, 7 ref.

Descriptors: *Ultimate disposal, *Reviews, *Waste water treatment, *Nuclear wastes, Nuclear power plants, Europe, Drying, Radioactivity, Effluents, Water purification, Filtration, Chemical precipitation, Evaporation, Separation techniques, Geologic formations, Technology, Water pollution treatment, Ion exchange.

The nuclear power stations in Germany and their radioactive effluents are described. Processes for decontamination of the effluents are outlined (chemical precipitation, mechanical filtration, ion exchange, and evaporation); and flow diagrams

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

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are given for treatment of effluents from pressurized- and boiling-water reactors. The separated waste is solidified before storage in a (salt-mine) geologic formation. Solidification techniques which are now undergoing further development include drum drying, pot calcining, spray drying, and drying and mixing with bitumen or polyethylene in a screw-conveyor-type dryer. (Bopp-ORNL) W72-10976

DIVISION OF RADIATION AND SAFETY, (ABTEILUNG STRAHLENSCHUTZ UND SICHERHEIT).
Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).

In: Bericht über Forschungs und Entwicklungsbereichen im Jahre 1971. p. 228-243. 36 ref.

Descriptors: *Radioactive wastes, *Nuclear wastes, *Waste treatment, Monitoring, Radioactivity, Radioactivity effects, Radioactivity techniques, Activated carbon, Solid wastes, Coagulation, Froth flotation, Tritium, Oil fields, Exploitation, Path of pollutants, Forecasting, Foreign research, Waste storage, Underground.

Studies were begun of chemical regeneration of activated carbon used in conventional (unradioactive) waste treatment. Steam at 200°C and 1 atm. gave 95% desorption of a test substance (dimethyl formamide). Consideration was given to injection of tritium-containing effluent into an exploited oil field until the present 50 atm. pressure is increased to the initial pressure of 100 atm. Processes developed for classification of highly radioactive waste (prior to storage) include the aluminothermic reaction. The radiation stability of bituminous fixed waste was studied. Separation of precipitates generated during treatment of radioactive effluents was facilitated by addition of small quantities of hydrophobic agents and flotation by air bubbles. Work is reported in radiation monitoring of and decontamination of gaseous and liquid effluents, and in underground storage of radioactive wastes. (Bopp-ORNL) W72-11077

FRP ACID WASTE LINE INSTALLED IN 12 DAYS.

Atlantic Bridge Co. Ltd., Mahone Bay (Nova Scotia).

W. B. MacDonald, G. A. Escher, and B. Molnar. Water and Sewage Works, Vol 117, No 7, July-August 1970, p IW/4-IW/7. 5 fig, 1 tab, 5 ref.

Descriptors: *Sewers, Industrial wastes, Installation, Acids, Construction, Materials, Temperature, Time, Reinforced concrete, Hydrogen ion concentration, *Pulp wastes, *Pipes, Waste water treatment, *Plastic pipes.

Identifiers: Sulfuric acid, Nitric acid, *Fiberglass reinforced plastic pipe (FRP).

Nova Scotia Pulp Limited had to replace its entire system of acid effluent line as the old tiled concrete line was severely corroded causing sections under the mill yard to collapse. The replacement pipe would have to be able to withstand nitric and sulfonic acids at a pH of 1-2 with temperatures ranging up to 100 deg F. FRP pipe was chosen for the new system. The main trunk line of 36 in. and 42 in. diameter pipe was encased in reinforced concrete so as to withstand the live loads of the mill yard and a railroad crossing. The pipe was installed in 40 ft. sections. Feeder lines of 24 in. diameter were not encased, but designed for direct burial under 10 ft. of backfill. A 500 ft. run of 18 in. FRP pipe was designed for suspension from hangers spaced at 8 ft. intervals. Corners were eliminated so that deposits could not buildup and cause high localized acid concentrations. Installation of the 3,500 ft. long FRP effluent system, including 4 manholes and two Parshall flumes required 13 days from ground breaking to completing backfill. (Galwardi-Texas) W72-11041

PLASTIC PIPE APPLICATIONS,
Olin Evanite Plastics, Carrollton, Ohio.

L. J. Adams.
Water and Sewage Works, Vol 117, No 4, April 1970, p 115-117.

Descriptors: *Plastic pipes, Installation, Water distribution, *Sewers, Sewage treatment, Industrial plants, Temperature, Pressure, Costs, Waste water treatment.

Identifiers: *Thermoplastics.

Current developments and future trends in the use of plastic piping in water, sewage and industrial waste systems were reviewed. Specific applications in each of these areas were described. Plastic pipe has been used in water purification plants, distribution systems and service lines. Economic considerations may be a limiting factor on the use of plastic pipe larger than 4 inches in diameter unless corrosion or other factors are of consequence. However, there have been dramatic developments in fiberglass reinforced thermoplastics which have doubled or even tripled pressure ratings without substantially increasing costs. Plastic piping has been used at every stage of sewage collection, handling, treatment and disposal. Two factors which have limited the extensive use of plastic pipe in sewer mains were the limited production capacity of the plastic pipe industry in 8-18 in. diameter sizes and the highly specialized nature of installation usually requiring on-the-job supervision. Also, a third limiting factor on the rapid development of plastic sewer mains has been the lack of an adequate standard. Plastic pipe for industrial waste applications should be supplied and installed on an engineered basis with each system being analyzed to determine what type and volume of effluent has to be handled, and at what pressures and temperature. (Galwardi-Texas) W72-11042

COST RELATIONSHIP OF BIOLOGICAL AND THERMAL PROCESSES FOR THE TREATMENT OF INDUSTRIAL EFFLUENTS,

Friedrich Uhde GmbH., Dortmund (West Germany).

J. Lohman.
Preprint, Presented at 6th International Water Pollution Research Conference, Session 8, Paper No. 16, June 21, 1972. 9 p, 11 fig, 5 ref.

Descriptors: *Industrial wastes, *Trickling filters, *Activated sludge, *Cost comparisons, Incineration, Laboratory tests, Performance, Aeration, Organic loading, Suspended solids, Cost analysis, Biochemical oxygen demand, *Waste water treatment, Plastics.

Identifiers: Plastics industry.

Wastewater from a plastics plant, assumed to be representative of a broad section of the plastics industry, was treated in the laboratory in 5 different treatment schemes. The five methods included: (1) activated sludge system; (2) plastic trickling filter; (3) series combination of trickling filter and activated sludge; (4) high rate activated sludge; and (5) incineration. Capital expenditure for such suggested plant was based on cost factors currently prevailing in the Federal Republic of Germany, and investment costs were assumed to be 17% of total annual capital expenditure. Results demonstrated that: (1) trickling filtration is particularly amenable to situations where partial treatment is required; (2) extensive purification is best achieved by the series combination of trickling filter followed by activated sludge; (3) the high rate activated sludge process is preferable to conventional activated sludge when extremely high degrees of BOD reduction are required; and (4) incineration is recommended for wastes with concentrations of BOD₅ greater than 30,000 to 50,000 mg/l. (Lowry-Texas) W72-11044

REGIONAL SEWER SYSTEM IS NO DREAM IN DETROIT.

Engineering News Record, Vol 185, December 1970, p 24-25.

Descriptors: *Waste water treatment, *Pollution abatement, *Regional analysis, *Sewage disposal, River basin development, Costs, Water pollution, Treatment facilities, Sewers, Phosphates, Oxygen, Construction, Design, Great Lakes region, Regional development, Municipal wastes.

Identifiers: Detroit (Mich), Regional system, Interceptor sewers, Ferrous chloride.

The Detroit Metropolitan Water Department (DMWD) has started building a massive regional sewage collection and treatment system. The regional program was designed to provide six counties with a system that will reduce water pollution in the Great Lakes and connecting waters, and make seven rivers and many smaller streams available for recreational use. The first phase of the expansion program called for the construction of a 28-mile-long interceptor sewer that will extend Detroit's service to 12 additional communities and the expansion of Detroit's treatment plant to accommodate the added load from a combined population of more than 3.4 million. Total cost of the first phase was estimated at \$160 million and will be financed in part by a 65 cent/1,000 CF service charge to users of the sewage disposal system plus an extra charge to communities on the new interceptors. Planned improvements to DMWD's treatment plant consisted of a 600 MGD aeration tank utilizing pure oxygen, two primary sedimentation tanks with a 300 MGD capacity and a 1.2 MGD final chlorine contact conduit. Removal of 80 percent of soluble phosphates has been accomplished by injecting ferrous chloride into two incoming interceptors. The cities of Warren and Pontiac, Michigan plan to expand their own systems. (Galwardi-Texas) W72-11045

THE EFFECT OF CILIATED PROTOZOA ON THE FATE OF ESCHERICHIA COLI IN THE ACTIVATED-SLUDGE PROCESS,

Water Pollution Research Lab., Stevenage (England).

C. R. Curds, and G. J. Fey.
Water Research, Vol 3, 1969, p 853-867. 5 fig, 2 tab, 18 ref.

Descriptors: *Activated sludge, *Protozoa, *Bacteria, Effluents, Laboratory tests, *Biological treatment, Sewage, Efficiencies, Performance, Mathematical tests, *Sewage treatment, *E. coli, *Waste water treatment.

Identifiers: Viable bacteria, England, Bacterial populations, Death rates, Concentrations.

The removal of E. coli from sewage in two bench-scale activated sludge plants was investigated in the absence of protozoa. Ciliated protozoa were then added to one of the plants and the results were compared. Results showed a decrease in E. coli from 1.4×10^6 to the 6th power E. coli/ml average inflow concentration to 6.5×10^6 to the 5th power E. coli/ml average effluent concentration in the absence of protozoa while the effluent concentration averaged 6.3×10^6 to the 4th power E. coli/ml in the presence of protozoa. With protozoa absent the half-life of E. coli in the plant was 16 hr. while in the presence of protozoa it was reduced to 1.8 hr. Thus, the addition of protozoa brought about a 9-fold increase in the death rate of E. coli. A decrease in the total viable bacteria in the effluent was also observed when protozoa were added to the activated sludge plant. A mean population of 2.6×10^6 to the 8th power viable bacteria/ml effluent was observed in the absence of protozoa and a mean population of 2.8×10^6 to the 7th power viable bacteria/ml effluent in the presence of protozoa. Thus, it was shown that protozoa play a dominant part in the removal of E. coli and viable bacteria from sewage. (Galwardi-Texas) W72-11047

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

SOME FACTORS RELATING TO THE DESIGN OF ACTIVATED-SLUDGE PLANTS,
P. B. B. Vosloo.
Water Pollution Control, Vol 69, No 5, 1970, p
486-494. 4 tab, 12 ref.

Descriptors: *Waste water treatment, *Design criteria, *Activated sludge, Effluents, Biochemical oxygen demand, Dissolved oxygen, Oxygen requirements, Nitrification, Temperature, Size, Settling basins, Aeration, Equipment, Mathematical studies, *Sludge treatment, *Treatment facilities.
Identifiers: Sludge loading rate, Sludge volume index, Sludge growth index, Sludge age, Nitrosomonas, Rate of sludge return.

Several factors relating to the design of activated sludge plants were reviewed and relationships were established where possible. Design factors considered were sludge loading rate, sludge volume index, dissolved oxygen and effluent BOD. Relationships between sludge loading rate, rate of production of new sludge, sludge age, sludge growth index, and dissolved oxygen requirements were reported. The effects of sludge loading rate on nitrification and the relationship between growth rate of Nitrosomonas and temperature were established. A BOD reduction of 90 percent in the activated sludge plant, exclusive of primary treatment, required a sludge loading of less than 0.4. The design of a conventional activated sludge system required to treat 1.1 MGD of settled sewage with a BOD of 200 mg/l was illustrated. The design included the size of aeration tank, rate of sludge return, capacity of aeration equipment, and size of final sedimentation tank. (Galwardi-Texas)
W72-11050

QUANTITATIVE PROCEDURE FOR EVALUATING THE PERFORMANCE OF WATER AND WASTE WATER TREATMENT PROCESSES AT NATURALLY OCCURRING VIRUS LEVELS,
Texas Univ., Austin. Dept. of Environmental Health and Engineering.
C. A. Sorber, J. F. Malina, Jr., and B. P. Sagik.
Environmental Science and Technology, Vol 6, No 5, May 1972, p 438-441. 4 fig, 2 tab, 17 ref.

Descriptors: *Viruses, *Membrane filters, *Water purification, *Bacteriophage membranes, Performance, Efficiencies, Hydrogen ion concentration, Temperature, Pressure, Laboratory equipment, Laboratory tests, Public health, Potable water, *Waste water treatment.
Identifiers: Coliphage T2, Cellulose acetate membrane, Membrane HT-00, Polyelectrolyte PE 60.

The insoluble polyelectrolyte technique for concentrating extremely low levels of viruses from artificial and natural waters was modified and standardized. The efficiency of virus recovery as a function of the number of plaque-forming units (pfu) was evaluated at levels down to 1×10^{-4} pfu/ml. The efficiency of concentrating the viruses was shown to be pH dependent and maximum recovery was at a pH of 5.25. Significant reduction in recovery efficiency resulted when pH values deviated as little as plus or minus 0.3 pH units. At the optimal pH, a constant virus recovery of 25% was achieved for the model coliphage T2 at concentrations of 10 to the 3rd power to 10⁻⁴ pfu/ml. The polyelectrolyte PE 60 was used in the water-washed form in all experiments. The ability of the PE 60 to adsorb essentially 100% of the virus in the suspension at the dose and mixing time employed was also demonstrated. The effectiveness of the methods described were applied to a membrane system of water treatment. The bench-scale membrane system utilized cellulose acetate, membrane HT-00, membranes. A virus level of 4.0×10^{-3} pfu/ml was found to pass the membrane which was heat-treated to a lesser degree so that the flux was in the range of 100-150 gal/ft²/day at a pressure of 41 atm. (Galwardi-Texas)
W72-11051

DEVELOPMENTS IN EFFLUENT TREATMENT IN THE FOOD INDUSTRY,
Atkins W. S. and Partners (England).

D. Anderson.
Water and Sewage Works, Vol 117, No 7, July-August 1970, p IW/12-IW/22. 3 fig, 2 tab, 3 ref.

Descriptors: *Industrial wastes, Foods, *Waste water treatment, *Cost trends, Cost sharing, Water costs, Pre-treatment, Treatment facilities, Water reuse, *Food processing industry, Canneries, Filters.

Identifiers: England, Treatment charges, Mogden formula, Treatability studies, Counterflow rinsing, High-rate biofilters.

Developments in effluent treatment related to the food industry in England were discussed. Trade wastes may be discharged into local authority sewers and a treatment fee based on a Mogden type formula has been charged. Operations dependent on volume only, removal of solid matter and oxidation processes have been considered by this cost formula. The basic charge has more than doubled during the period from 1962 to 1968, as shown by the increase from 7.16 to 15.72 cents/1000 imperial gallons. Treatability studies of effluents relying on chemical tests must be considered. Also, water recycle systems must be considered due to the increasing costs of raw water and waste discharges. The combined cost of raw water and waste discharges has increased from 25 to approximately 50 cents/1000 imperial gal. during the 1961-1969 period. The process of counterflow rinsing should be considered in an attempt to save water. Two examples of effluent pre-treatment facilities utilizing high-rate biofilters were presented. (Galwardi-Texas)
W72-11052

OUTLET WEIRS FOR TRAPEZOIDAL GRIT CHAMBERS,

Indian Inst. of Science, Bangalore.
N. S. L. Rao, and D. Chandrasekaran.
Journal Water Pollution Control Federation, Vol 44, No 3, March 1972, p 459-469. 11 fig, 3 tab, 11 ref.

Descriptors: *Sedimentation, *Silts, *Flow control, *Weirs, Sands, Laboratory tests, Particle size, Efficiencies, Stoke's Law, Reynolds number, Design criteria, Waste water treatment.
Identifiers: *Grit.

Three types of outlet weirs for use in trapezoidal chambers were designed and tested to investigate their potentialities as grit-trapping devices. Of the three weirs developed, one was designed to maintain a constant flow velocity, another was designed to vary the mean velocity inversely with head, and the third decreases the mean velocity linearly with head. Experimental laboratory settling data on sand mixtures showed the weirs achieved removal efficiencies as high as 80 to 95%. In demonstrating the effectiveness of the weirs as grit-trapping devices, the adequacy of Hazen's ideal tank settling theory for application to practical (non-ideal) trapezoidal grit chambers was established. (Lowry-Texas)
W72-11054

MICROBIAL PROCESS FOR ACIDIC LOW-NITROGEN WASTES,

Virginia Polytechnic Inst. and State Univ., Blacksburg.

C. W. Randall, H. R. Edwards, and P. H. King.
Journal Water Pollution Control Federation, Vol 44, No 3, March 1972, p 401-413. 13 fig, 4 tab, 14 ref.

Descriptors: *Acid streams, *Nutrient requirements, *Fungi, *Molds, Laboratory tests, Aeration, Organic loading, Screens, Efficiencies, Hydrogen ion concentration, Suspended solids, Nitrogen, Sludge, *Waste water treatment.

Aeration in tanks with vertical screens to which filamentous organisms can attach themselves has

been demonstrated to be highly efficient for treatment of acidic and nitrogen deficient wastes. When operated at an 8 hour detention time, an experimental system achieved 90% COD removal or better of influent concentrations as high as 1000 mg/l over a pH range of from 7.5 to 4.0. Below pH 4.0, removal efficiency decreased gradually from 95 to 85%, at pH 2.65, and decreased sharply at pH below 2.65. Process organic removal efficiency was a function of screen hydraulic loading rate and screen organic loading rate. Above 37 g/day/ft² of screen area, efficiency decreased as organic loading increased. No solids separation difficulties were experienced, and nitrogen requirements were only 20% of those recommended for activated sludge. (Lowry-Texas)
W72-11056

PHASIC UTILIZATION OF SUBSTRATES BY AEROBIC CULTURES,

Georgia Inst. of Tech., Atlanta.
S. Ghosh, F. G. Pohland, and W. E. Gates.
Journal Water Pollution Control Federation, Vol 44, No 3, March 1972, p 376-400. 13 fig, 5 tab, 47 ref.

Descriptors: *Kinetics, *Growth rates, *Mathematical models, Laboratory tests, Metabolism, Enzymes, Population, Temperature, *Waste water treatment, *Cultures, Aerobic conditions.
Identifiers: *Mixed substrates, Assimilation, Repression, Specific growth rate, True yield.

Mathematical models were developed to describe sequential and concurrent assimilation in continuous flow and batch processes, and were verified by laboratory experiments using glucose and galactose. In multi substrate media, growth yields and specific growth rates were controlled by that substrate which permits the highest specific growth rate, the highest true yield coefficient, and the lowest saturation constant when provided as the sole carbon and energy source. Assimilation kinetics of the primary substrate, the substrate permitting the highest specific growth rate, etc., were unaffected in the presence of the secondary substrate, but the specific elimination of the secondary substrate was greatly repressed when the primary substrate concentration was increased. Despite the repression phenomena, both primary and secondary substrates may be assimilated concurrently at all detention times in heterogeneous dispersed growth processes because of the population dynamics and enrichments of new dominant cultures occurring in response to shifts in the levels of environmental stresses. (Lowry-Texas)
W72-11057

FACTORS AFFECTING PH CHANGES IN ALKALINE WASTE WATER TREATMENT-I,
Technische Hogeschool Twente, Enschede (Netherlands).

L. Luklema.
Water Research, Vol 3, No 12, December 1969, p 913-930. 9 fig, 4 tab, 30 ref.

Descriptors: *Industrial wastes, *Alkalinity, *Biodegradation, Oxidation, Nitrification, Carbon dioxide, Carbonates, *Hydrogen ion concentration, Pilot plants, Kinetics, Mathematical models, *Waste water treatment.
Identifiers: *Carbonic acid equilibria, *Desorption.

An experimental activated sludge pilot plant was operated on weakly, moderately, and strongly alkaline influents to assess the most relevant factors that influence the pH, and of their quantitative relationships. The pH was demonstrated, both experimentally and theoretically, to depend primarily on the carbonic acid equilibria. Since the pH change is controlled by two factors, including the production of acid or alkaline substances during biological purification and the buffer capacity of the influent, the relations between pH and the concentrations of carbon dioxide, carbonate, and bicar-

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bionate can be calculated. Several (bio) chemical and physical processes occurring in biological purification studied included carbon dioxide desorption, oxidation of organic matter and nitrification. Mathematical models for effluent pH calculations were formulated and the theoretical values so obtained were compared with experimental results. (Lowry-Texas)
W72-11058

CLARIFIERS FOR WASTE WATER TREATMENT IN THE SWEDISH PULP INDUSTRY,
Swedish Water and Air Pollution Research Lab.,
Stockholm.
P. Ullman.

Proceedings, Industrial Waste Conference, 25th, May 7-9, 1970, p 783-794, 6 fig, 5 tab.

Descriptors: *Industrial wastes, *Pulp wastes, *Settling basins, Depth, Performance, Chemical precipitation, Biochemical oxygen demand, Chemical oxygen demand, Color, *Sludge treatment, Scour, Mechanical equipment, Suspended solids, Recycling, *Waste water treatment.
Identifiers: *Sweden, Alum, Surface loading rates, *Clarifiers.

The clarifiers for treatment of fiber rich wastewater at five pulp and paper mills in Sweden were studied from different points of view. At three mills the clarifiers were investigated with respect to how variations in the applied load affected the performance. Results indicated that the breakthrough load of a clarifier depended primarily on the clarifier depth. Varying amounts of settled sludge and mechanical sludge removing devices presented problems. At one mill, the presence of suspended solids from backwash operations in the influent had a favorable effect on the clarifier performance due to a decreased scouring of the sludge layer. At another mill the clarifier included a unit for chemical flocculation. The clarifier performance, regarding the removal of color, BOD, COD (measured as permanganate consumption) and suspended solids was studied. A BOD removal of approximately 65 percent was achieved with an alum dose of 100 to 150 mg/l. The sludge from the clarifier of this mill has been completely recovered by mixing into a low grade wrapping paper. (Galwardi-Texas)
W72-11059

TREATMENT OF COMPLEX PETROCHEMICALS BY INCINERATION AND WASTE STABILIZATION PONDS,
Texas Univ., Austin. Coll. of Engineering.
E. F. Glynna, M. C. Herring, and D. L. Ford.
Proceedings, Industrial Waste Conference, 25th, May 7-9, 1970, p 389-397, 10 fig, 2 tab.

Descriptors: *Industrial wastes, *Pollution abatement, *Incineration, *Oxidation lagoons, Chemical oxygen demand, Treatment facilities, Laboratory tests, Pilot plants, Installation costs, *Operating costs, *Waste water treatment, Texas.
Identifiers: *Petrochemicals, In-plant abatement, Total organic carbon, Wet incineration.

An effective wastewater management program has been implemented at Jefferson Chemical Company's Course, Texas Plant. The success of the in-plant abatement program was reflected in the fact that a 99.4 percent reduction in potential pollutants has been accomplished in the past eight years while plant production increased approximately 350 percent. The remaining pollutants were treated in a carefully designed system using liquid incineration and waste stabilization ponds. A substantial savings in capital treatment costs was realized as a result of preliminary laboratory and pilot plant investigations. The wastewater collection, treatment and disposal operation consisted of three separate systems. The Open-Top Incinerator System was designed to collect and dispose of concentrated organic wastes through smokeless burning. The Thermal Oxidizer System was designed to dispose of aqueous wastes having or-

ganic concentrations ranging from 600 mg/l to 10 percent organics, and the Waste Stabilization Pond System to collect and further treat all plant rainfall and wastewater containing less than 600 mg/l organics. To date, a total of \$842,000 has been invested in pollution abatement facilities and the cost of operating these facilities during the calendar year of 1970 may exceed \$200,000. (Galwardi-Texas)
W72-11060

THE DISPOSAL OF WATER BRINE FROM DESALTING OPERATIONS,
Dow Chemical Co., Freeport, Tex.
For primary bibliographic entry see Field 03A.
W72-11061

MAJOR FILTRATION DEVELOPMENT AT NEW STEEL MILL,
Hydromatron Engineering Co., Livonia, Mich.
R. H. Wykoff.
Water and Sewage Works, Vol. 117, No. 7, July-August, 1970, p 418-420, 2 fig.

Descriptors: *Waste water treatment, *Filtration, Treatment facilities, *Filters, *Industrial wastes, *Steel, Materials, Efficiencies, Performance, Oil, Depth, Design data, Flow characteristics, Cooling water, Settling basins, Automatic control, Suspended solids.
Identifiers: Media, Marvinol No. 2001, Grease, Strainer, Steel slabbing mill.

A new concept in automated filtration systems has been filtering and recirculating 12,000 gpm of cooling water to the hot slabbing mill and scarfing operations at Ford Motor Company's new steel slabbing mill. Influent suspended solids and tramp oils and greases average 800 and 160 mg/l respectively, while the effluent has consistently contained only 1 to 5 mg/l and 0.5 to 3 mg/l respectively. The new depth filter uses a permanent polymer resin filter medium, Marvinol No. 2001, developed by Uniroyal Chemical. The new medium has chemical resistance to all but chlorinated hydrocarbon solvents. Oils, greases, metal oxides, and other similar contaminants can be easily scrubbed from the media grains without harmful effect. The filters, based on a space saving radial design, measure 9 feet in diameter and 16 feet tall and have been operated at 4000 gpm each. The filter cycles have been averaging 2 hr and backwash cycles 10 min. The medium has been cleaned by removing it from the filter hydraulically and pumping it through a dynamic scrubbing mechanism at velocities exceeding 20 fpm. The system automatically backwashes at a predetermined pressure differential of 30 psi. Primary and secondary settling basins and a strainer system which precede the filters units reduce the suspended solids to approximately 150 mg/l and the oils and greases to 80 mg/l. (Galwardi-Texas)
W72-11062

DESIGN OF TWO-STAGED AERATED LAGOONS,
Rex Chainbelt, Inc., Waukesha, Wis.
R. A. Kormanik.
Journal Water Pollution Control Federation, Vol 44, No. 3, March 1972, p 451-458, 2 fig, 4 ref.

Descriptors: *Aerated lagoons, *Design criteria, *On-site investigations, *Aerobic conditions, Anaerobic conditions, Mathematical models, Municipal wastes, Biochemical oxygen demand, Suspended solids, Construction costs, *Waste water treatment.
Identifiers: *Facultative lagoons.

A two-stage aerated lagoon system operated in series, consisting of an aerobic lagoon first stage and a facultative lagoon second stage, has been shown both mathematically and experimentally to require less total detention time than either an aerobic lagoon or a facultative lagoon used separately. The mathematical development indicates that total

system detention time depends on intermediate soluble BOD, and specifically a unique amount of soluble BOD removed in the first-stage lagoon will yield the minimum total detention time for this system. Lagoon system design procedure involves: (1) determination of intermediate soluble BOD level for minimum detention time from equation given; (2) further manipulation of equations given to establish detention times in each facility; and (3) optimization of various combinations of area and depth to provide desired detention time using land cost and excavation costs as variables. (Lowry-Texas)
W72-11064

SLUDGE YIELDS IN AEROBIC SYSTEMS,
Oklahoma State Univ., Stillwater.
M. Ramanathan, and A. F. Gaudy, Jr.
Journal Water Pollution Control Federation, Vol 44, No. 3, March 1972, p 441-450, 1 fig, 4 tab, 14 ref.

Descriptors: *Municipal wastes, Microorganisms, *Metabolism, *Sludge, Laboratory tests, Respiration, Oxidation, Biodegradation, Free energy, Nitrogen, Biochemical oxygen demand, *Waste water treatment, *Aerobic conditions.
Identifiers: *Sludge yield, *Sugars, *Heat content.

Sludge yields obtained over a period of 10 years in laboratory studies under comparable conditions in aerobic systems have evidenced wide variations, attributed mainly to species predominance changes in the wastewater seed. For sugars and sugar alcohol substrates, average yields were about 50% (1 gm sludge produced for each 2 gms of substrate utilized), with a typical range for any one substrate extending from the low 30's to the 60's. Similar values have been recorded for dual substrate systems as well. At a given dilution rate, yields were higher at higher ratios of chemical oxygen demand to nitrogen. Attempts to predict yield on the theoretical basis of free energy content or heat content of the carbon source met with considerable difficulty because of the variability introduced by species predominance shifts. However, realistic sizing of sludge handling and disposal facilities can be accomplished by designing for a yield range of 40 to 60%. (Lowry-Texas)
W72-11065

EFFECTS OF TREATMENT PLANT EFFLUENT ON SOIL PROPERTIES,
Arizona Agricultural Experiment Station, Tucson.
A. D. Deay, J. L. Stroehlein, and T. C. Tucker.
Journal Water Pollution Control Federation, Vol 44, No. 3, March 1972, p 372-375, 3 tab, 10 ref.

Descriptors: *Soils, *Activated sludge, *Irrigation, *Water reuse, Field crops, Dissolved solids, Calcium, Magnesium, Potassium, Phosphorus, Nitrogen, Nutrient requirements, Sands, Silts, Infiltration, *Waste water treatment.

Effluent from the Tucson, Arizona wastewater treatment plant was used to irrigate field crops from 1956 through 1969. The effluent had received standard activated sludge treatment and contained approximately 24, 8, and 10 mg/l of nitrogen, phosphorus, and potassium, respectively. The soil which was irrigated was a Grabe silt loam (sand-40%, silt-40%, clay-20%, organic matter-1.5%). Random soil samples were taken from 4 locations in both a field receiving effluent and a field irrigated with well water and fertilized as recommended with N, P, and K. At each location, the A horizon (plow layer, 0 to 25 cm) and C horizon (sub-soil, 38 to 51 cm) were sampled separately. The Ap horizon for both fields had higher concentrations of soluble salts and minerals than the C horizons. Soil irrigated with treatment plant effluent had a lower water infiltration rate, higher modulus of rupture, and higher salt and mineral content than soil irrigated with well water. However, crop yields were not decreased by effluent irrigation nor were there any adverse effects on the soil which could not be corrected by minor changes in field crop culture. (Lowry-Texas)

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Group 5D—Waste Treatment Processes

W72-11066

BACTERIAL EXOCELLULAR POLYMERS AND BIOLOGICAL FLOCCULATION, Louisville Univ., Ky. Dept. of Civil Engineering. J. L. Pavoni, M. W. Tenney, and W. F. Echelberger, Jr. *Journal Water Pollution Control Federation*, Vol 44, No. 3, March 1972. p 414-431, 21 fig, 44 ref.

Descriptors: *Polymers, *Flocculation, *Bacteria, Laboratory tests, Separation techniques, Centrifugation, Turbidity, Protein, Activated sludge, *Waste water treatment, Biological treatment.

Identifiers: *Exocellular polymers, Polysaccharides, DNA, RNA.

Laboratory scale batch tests were designed to investigate exocellular polymer production in mixed cultures of activated sludge type bacteria. Once a bacterial batch unit was initiated, the experimental procedure consisted of recording the following parameters: (1) microorganism mass (dry weight basis); (2) culture flocculation as a function of either cake filtration time, percent transmission at 690 millimicrons following settling, or relative turbidity following settling; and (3) dry weight and fractional composition of extracted exocellular polymer. Results indicated a direct correlation between polymer production and biological flocculation, with maximum agglutination occurring during endogenous growth stages. Removal of polymer from cell surfaces by centrifugation caused appearance of a stable dispersion on resuspension; readdition of extracted polymer caused reflocculated suspensions. Addition of polymer, containing polysaccharides, proteins, DNA, and RNA to clay and bacterial suspensions also resulted in flocculation. Probable cause of the flocculation tendencies of the polymer was electrostatic or physical bonding with subsequent bridging of the cells of the dispersion into a settleable matrix. (Lowry-Texas)
W72-11067

SE. Ultimate Disposal of Wastes

LIME SLUDGE AND ITS DISPOSAL, Grand Rapids Dept. of Water, Mich. For primary bibliographic entry see Field 05D.
W72-10542

WATER PLANT SLUDGE DISPOSAL, Dow Chemical Co., Midland, Mich. For primary bibliographic entry see Field 05D.
W72-10543

MARINE WASTE DISPOSAL SYSTEMS: ALTERNATIVES AND CONSEQUENCES, California Univ., Berkeley. For primary bibliographic entry see Field 06G.
W72-10584

EVALUATION OF SALT WATER DISPOSAL INTO POTENTIAL GROUND-WATER RESOURCES, Oklahoma Corp., Commission, Oklahoma City. For primary bibliographic entry see Field 05B.
W72-10895

THE DISPOSAL OF WATER BRINE FROM DESALTING OPERATIONS, Dow Chemical Co., Freeport, Tex. For primary bibliographic entry see Field 03A.
W72-11061

SF. Water Treatment and Quality Alteration

SULFATE-REDUCING VIBRIONS AND BIOLOGICAL CORROSIONS, (IN FRENCH), Institut Pasteur, Lille (France). Laboratoire d'Hydrobiologie. For primary bibliographic entry see Field 05A.
W72-10528

BACKWASH INVESTIGATION AND A PROPOSED SIMPLE UNIFORMITY CONTROL, Shreveport Dept. of Water and Sewerage, La. A. A. Hirsch.

Journal of the American Water Works Association, Vol 60, No 5, p 570-585, May 1968. 11 fig, 3 tab, 5 ref.

Descriptors: *Temporal distribution, Suspended solids, *Cleaning, Filtration, Filters, *Louisiana, *Water treatment.

Identifiers: *Backwash, Bed structure, Filter washwater, *Shreveport (La).

Backwash characteristics, washing process dynamics, effect of bed structure, and theoretical considerations for filter design were investigated. Suspended solids concentrations of backwash samples taken at the troughside bottom, intermediate median, a corner, and the sewer were measured. Sampling intervals were 1/15 seconds. Testing at Shreveport, Louisiana, showed washwater streaks toward trough edges. Uniform washwater removal over the entire filter surface was achieved utilizing nozzles 6 inches apart on center above the filter bed. Short-circuiting in backwash must be avoided. A measured velocity profile showed that washwater is wasted, operation and maintenance problems are initiated, and uneven filtering occurs following non-uniform washing. The area 5 under backwash curves of suspended solids concentrations versus time give sediment removed. Peak backwash concentrations decay logarithmically. Formulations are presented for determining decay and washing efficiency. Inversely graded beds yielded broader backwash curves than traditional filters. Most thorough washing occurred at the bottom of the vertical walls of the trough. Draw-off members can be classified according to simple geometric counterparts. Filter beds wash unevenly due to the directional influence of the washwater troughs. (Nardozzi-AWWA)
W72-10539

MAGNESIUM CARBONATE FOR WATER TREATMENT, Cincinnati Univ., Ohio. For primary bibliographic entry see Field 05D.
W72-10541

CONDITIONING OF WATER SOFTENING PRECIPITATES, Springfield Dept of Water, Light and Power, Ill. C. H. Spaulding. *Journal of the American Water Works Association*, Vol 29, No 11, p 1697-1707, November 1937. 1 fig, 1 tab, 2 ref.

Descriptors: *Water softening, Filtration, *Coagulation, *Water treatment, Waste water treatment, Sludge treatment. Identifiers: Agglomeration, Thickening.

A process modification to conventional coagulation that could reduce floc carryover to the filters is discussed. A softening precipitator was constructed to produce soft water and agglomerate small particles into larger coagulated masses that are more easily filterable. Experience with sludge return showed tastes and odors were imparted and a fine hard-to-remove turbidity resulted. Laboratory and plant scale precipitator mixing and settling equipment are described. Plant tests were run on modified and conventional units. The precipita-

tor was ten times more efficient than the conventional basin. Formulas developed for precipitator diameter and height were modified to meet excessive depth limitations. This reactor supports precipitates in the settling compartment by means of vertical velocities. The precipitator sludge is concentrated to 5-15% in thickeners and supernatant water is returned to the raw water well. Physical and chemical data are presented for 6 months operation. Water from the precipitators to the filters is generally less than 1 ppm turbidity and is filtered rapidly. (Nardozzi-AWWA)
W72-10544

THE SANITARY SIGNIFICANCE OF ESCHERICHIA COLI IN VARIOUS CONDITIONS OF WATER DECONTAMINATION WITH RESPECT TO ENTEROVIRUSES, (IN RUSSIAN), For primary bibliographic entry see Field 05C.
W72-10560

CHLORINE RESIDUAL CONTROLLING SYSTEM,

General Signal Corp. (assignee). W. H. Frazel, Q. C. Turtle, and T. Yip. U. S. Patent No. 3,528,545, 5 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 878, No. 3, p. 656, September 15, 1970.

Descriptors: *Patents, *Water treatment, Water purification, *Chlorine, Water pollution, Water pollution treatment, Water water, *Waste water treatment, Pollution abatement, *Treatment facilities.

In a water treatment plant, the chlorine feed rate is controlled by a sampled-data, proportional speed floating control system. This system sizes corrective action to the error and provides a waiting interval of sufficient length to permit the result of that correction to be detected before further corrective action is initiated. The waiting interval prevents overshooting results from the use of non-current feedback data. The control action is proportional to the magnitude of the error thereby it precludes providing too little or too much correction. (Sinha-OEIS)
W72-10760

PLANS FOR MEETING WATER REQUIREMENTS, IN THE KASKASKIA RIVER BASIN, 1970-2020, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 06B.
W72-10785

FEDERAL ASSISTANCE SPURS WATER SUPPLY IMPROVEMENTS, Black and Veatch, Consulting Engineers, Kansas City, Mo. D. H. Doty, and D. P. Proudfoot. *Public Works*, p 85-87, August 1971. 2 fig, 1 tab.

Descriptors: *Water supply, *Water treatment, Financing, Water requirements, Instrumentation, Costs, Treatment facilities, Municipal water. Identifiers: *Federal assistance, *El Dorado (Kans), Plant capacity.

Availability of a new water source provided by the Corps of Engineers and a basic water facilities grant from the Department of Housing and Urban Development has prompted the city of El Dorado, Kansas to increase the capacity of its water treatment plant and update the facilities. An investigation projected an increase in treated water consumption from 1.4 mgd in 1964 to 2.2 mgd in 1980. The 1980 maximum daily rate plus the 10 hour fire demand rate totals about 10 mgd. The low bid on the project was \$89,000 dollars out of which \$438,500 dollars were obtained through grants from HUD. The proposed improvements changing from a two-stage to a one-stage flow pattern are described. It is expected that upon completion of

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Water Treatment and Quality Alteration—Group 5F

all improvements, El Dorado will have a thoroughly modern, efficient treatment plant, equal to any in Kansas. (Upadhyaya-Vanderbilt) W72-10821

PRELIMINARY SURVEY OF CONCENTRATION OF FLUORINE IN POTABLE WATER IN NORTHERN BIHAR,

Indian Veterinary Research Inst., Izatnagar.
For primary bibliographic entry see Field 05B.
W72-10824

EFFECT OF WATER CONDITIONING ON WASTEWATER QUALITY,

Orange County Flood Control District, Santa Ana, Calif.

J. W. Williams.
Journal of the American Water Works Association, Vol. 60, No. 12, p 1329-1335, December 1968. 7 ref.

Descriptors: *Ion exchange, Water softening, Chemical precipitation, Water hardness, Costs, Water reuse, *Water treatment.

Identifiers: *Sodium zeolite, Exchanger, Regeneration.

Chemical precipitation and ion-exchange softening of water are discussed. Types of hardness are described. Softening costs at filtration plants are as low as \$0.03/1000gal/100ppm hardness removed. Unit costs are higher for lime-soda ash softening when significant non-carbonate hardness is present. Savings of 11.7cents/1000gal/100ppm hardness removed are estimated for soap, detergents, lyes, bleaches, shampoos, hand lotions, coffee, tea, fuel, washable clothing, linens, towels, and plumbing repairs. Soft water is more corrosive than hard water. Chemical precipitation softening equations are presented. Ion exchange is preferable when substantial non-carbonate hardness exists; waters contain less than 100ppm hardness; low effluent hardness is required; sludge disposal facilities are not available; and small water volumes need softening. Regeneration of resins is by backwashing, ion replacement, and rinsing. Waste products are excess regenerant and hardness ions. Softening capacity is usually expressed as grains hardness as CaCO₃ removed/cu ft resin. Most economic salt usage is 0.3-0.5lbs/1000grains hardness removed. Wastewater reclamation may be feasible by membrane processes on waters of 1000 TDS. Other disposal methods are discharge to ocean outfalls, sewers, or deep well injection. (Nardozzi-AWWARF)
W72-10921

HOW SERIOUS IS THE PROBLEM,

Hazen and Sawyer, New York.

H. E. Hudson, Jr.
In: Proceedings Tenth Sanitary Engineering Conference, Waste Disposal from Water and Wastewater Treatment Processes, University of Illinois, Urbana, Feb 6-7, 1968, p 1-6. 6 ref.

Descriptors: *Recycling, Polyelectrolytes, Sewage treatment, *Water treatment.

Identifiers: *Water sludge, Filter washwater, Basin sludge, Calcining, Alum recovery, Vacuum filtration.

Public and industrial water consumption totals 150 and 360 tons/capita/year respectively. Over 60 millions tons/year of water and wastewater sludges (dry basis) are generated. Sludge loads from water treatment plants are 15 pounds/capita/year. The handling of waste quantities must be done to create equilibrium conditions with the environment. Detroit, Michigan recycles filter washwater and benefits by improved settling and filtration. Seasonally cleaned basins require separate treatment or holding facilities while continuous sludge removal units could discharge to sewers. Zeolite softening and electrodialysis brine streams have been diluted by discharge to streams. Calcining

and reuse is suggested for chemical precipitation softening waste, with magnesium separated or recovered. Clarification sludges can be vacuum filtered with lime conditioning. Alum recovery is practiced in Japan. Cationic polyelectrolytes may become effective as primary coagulants. Water treatment plant sludges would add a 10% solids loading to sewage treatment plants. Economic methods must be developed to recycle wastes. (Nardozzi-AWWARF)
W72-10922

PONTIAC RECALCINING PLANT,

Jones and Henry, Toledo, Ohio.
B. H. Swab.
Journal American Water Works Association, Vol. 40, No. 4, p 461-467, April 1948. 2 fig, 3 tab, 4 ref.

Descriptors: *Water softening, Centrifugation, Costs, Dewatering, *Recycling, Drying, *Sludge treatment, Calcium carbonate, *Lime.

Identifiers: *Recalcining, Flash drying.

The City of Pontiac (Mich) incorporated provisions to dry 28 tons/day of calcium carbonate sludge and recover the lime at their water softening facility. The three stage operation included dewatering, classifying, and rejecting a portion of the magnesium and other impurities by continuous centrifugation; drying in the Raymond Flash Drying System; and calcination by exposing dried material to a temperature of 1900F. The carbonate precipitate is transported to slow-speed stirring slurry receiving tanks. Concentrated slurry is discharged to two continuous centrifuges. The magnesium and other impurities are passed to the sanitary sewer and the calcium carbonate is conditioned prior to flash drying. The flash drier is composed of a cage mill and blower. Dried material is calcined in a furnace with the CaO sent to storage bins. The maximum operating cost per ton (CaO) is \$7.95. (See W72-10925 and W72-10926) (Nardozzi-AWWARF)
W72-10924

PONTIAC RECALCINING PLANT, DISCUSSION,

Dorr Co., New York.

A. J. Fischer.
Journal American Water Works Association, Vol. 40, No. 4, p 465-466, April 1948. 1 fig.

Descriptors: *Calcium carbonate, Centrifugation, Costs, Recycling, Drying, *Lime, *Sludge treatment.

Identifiers: *Recalcining, Fluo Solids Calciner, Rotary kiln, Flash drying.

The calcining of lime has been practiced in the heavy chemical and paper pulp industries for several years. In the water treatment industry, lime reclamation has been economical when burning 25 tons CaO/day in conventional rotary kilns. The Fluo Solids Calciner recalculates dry calcium carbonate sludge in a air fluid suspension. Fluidized suspension burning has been used in the petroleum industry for roasting ores. Sludge from the precipitates is centrifuged, conditioned with soda ash and dried sludge, passed to a Raymond flash drier, and burned in the Fluo kiln. The kiln temperature is 1750F with the CaO pellets discharged at a temperature of 300F. The advantages of this system are compactness, low installation cost, low operation and maintenance costs, and dust free operation. (See also W72-10924 and W72-10926) (Nardozzi-AWWARF)
W72-10925

PONTIAC RECALCINING PLANT, DISCUSSION,

Combustion Engineering Inc., Chicago, Ill.

C. W. Gordon.
Journal American Water Works Association, Vol. 40, No. 4, p 466-467, April 1948.

Descriptors: *Calcium carbonate, Centrifugation, Recycling, Drying, *Lime, *Sludge treatment.

Identifiers: *Recalcining, Flash drying, Fuel consumption, Power consumption.

The C-E Raymond Flash Drying System rapidly dries materials in the fine to granular form. The complete conversion of a dewatered centrifuge calcium carbonate cake to a dried and preheated power requires a few seconds. The calcining furnace decomposes calcium carbonate to quicklime and collects the finished product. The positioning of the oil burners is critical for short duration complete calcining. At Marshalltown, Iowa, an 80% lime content is reclaimed out of a theoretical 84% content. Coagulation with the reclaimed lime is excellent. Furnace temperatures are traced throughout the system. Flash drying is of the two-stage, counterflow type. At Marshalltown, one ton of high quality finished lime is produced with a fuel consumption of 9.66 millions Btu. The power consumption is 60kwhr/ton finished lime. (See also W72-10924 and W72-10925) (Nardozzi-AWWARF)
W72-10926

EXPERIENCES IN POLYMER APPLICATIONS TO SEVERAL SOLIDS-LIQUIDS SEPARATION PROCESSES,

Dow Chemical Co., Midland, Mich.

For primary bibliographic entry see Field 05D.
W72-10927

DEWATERING BY LAGOONS AND DRYING BEDS,

O'Brien and Gere, Syracuse, N.Y.

For primary bibliographic entry see Field 05D.
W72-10928

ACTION NOW IN FILTER PLANT WASTE-WATER TREATMENT,

Malcolm Pirnie, Inc., White Plains, N.Y.

G. P. Westerhoff.

Paper Presented at Spring Meeting of the New York Section of the American Water Works Association, Syracuse, New York, April 6, 1972. 16 p, 3 fig, 9 ref.

Descriptors: *Sludge treatment, Centrifugation, Recycling, *Water treatment, Filtration, New York, Treatment facilities.

Identifiers: *Alum recovery, *Waste reduction, Alum coagulation, Filter washwater, Thickening, Liquid-solids separation, Waste characterization.

A two phase program is outlined to evaluate alum coagulation sludge and filter washwater treatment processes. Alum sludge is difficult to dewater. Sturgeon Point (N.Y.) treatment includes: aeration, chemical addition, mixing, flocculation, sedimentation, filtration, pH adjustment, fluorination, and chlorination. Plant scale design data must be developed for wastes. Alum sludge solids, consisting of Al(OH)₃ and organic and amorphous materials, vary from 50-200lbs/million gallons of water produced. A composite backwash water analysis showed 65lbs solids/million gallons filtered water. Basic proposed facilities include: sludge and washwater holding tanks, thickener-clarifier, waste lagoons, centrifuge, filter press, half-scale alum recovery plant, and backwash recycling equipment. Alum recovery is expected to reduce waste solids to one-sixth their original volume and produce a reusable alum. The recovery process includes thickening of sludge, acidulation with H₂SO₄, thickening-separation, filter pressing, feed systems, control equipment, recovered alum storage, and recycling, all on batch or continuous bases. Preliminary work showed no iron or color build-up in reclamation. The study programs aim to: identify physical-chemical waste character; evaluate liquid-solids separation with and without aids; determine feasibility of alum recovery; evaluate recovered alum effects on plant operation; and reduce backwash water flow quantities. (Nardozzi-AWWARF)
W72-10929

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5F—Water Treatment and Quality Alteration

WATER AND WASTEWATER TREATMENT PLANT SLUDGES, Stilson (Alden E.) and Associates, Ltd., Columbus, Ohio.

K. W. Cosenz.

Paper Presented at West Virginia Joint Section Meeting, American Water Works Association and Water Pollution Control Association, Wheeling, West Virginia, April 6, 1972, 25 p, 15 ref.

Descriptors: *Sludge treatment, Water softening, Landfills, Centrifugation, Water treatment, Waste water treatment, Waste disposal, New Jersey, Ohio, Recycling, Sludge, *Sludge disposal.

Identifiers: Alum coagulation, Iron salt coagulation, Filter washwater, Filter press, Lime recovery, Magnesium recovery.

Water treatment sludges include: clay, silt, and sand from plain sedimentation of turbid river water; alum coagulation of color and turbidity; iron salt coagulation; iron-manganese removal by aeration; softening; filter washing; and microstraining and diatomaceous earth filtration. Data are given for particle size and settling velocities of alum and iron flocs; sand, salt, and clay flocs; and softening wastes. Softening of surface water produces 3.5 lbs dry solids/pound of hardness removed as CaCO₃. Sludge treatment or disposal methods are dilution, lagoons, sand drying beds, vacuum filtration, freezing, filter pressing, centrifugation, land disposal, recovery, and discharge to sanitary sewers. The Little Falls (N.J.) plant plans to thicken sedimentation coagulation sludge and settle washwater. Concentrated sludge is held, centrifuged, conditioned by lime and polymer, and pressed with the cake used for landfill. Presses process 50 tons/8 hours. Portsmouth, Ohio, plans vertical basket centrifugation of alum sludge and land disposal. Columbus, Ohio, proposes recovering magnesium and lime from softening sludge in a 10 gpm pilot facility. Fremont, Ohio, plans centrifugation of softening sludge and land disposal in quarries or farm fields. St. Paul recycles their lime sludge. Lime and magnesium recovery methods are mentioned. (Nardozzi-AWWARF) W72-10930

ADVANCES IN THE CENTRIFUGAL Dewatering of SLUDGES,

O. E. Albertson, and E. J. Guidi, Jr.

Water and Sewage Works, Vol. 114, p R-133-R-142, 1967. 14 fig, 4 tab.

Descriptors: *Centrifugation, *Dewatering, *Sludge treatment, Waste water treatment, Pulp wastes, Industrial wastes, Water softening, Water treatment, Waste treatment.

Identifiers: *Machine variables, *Process variables, Clarification, Recovery.

The utility of centrifugation to treat sanitary and industrial wastes is outlined. An early history of perforated and imperforate basket, solid-bowl, and disc-valve centrifuges is presented. Conical centrifuges classify and dewater; cylindrical units recover fine particles in clarification; and cylindrical-conical devices are most suitable for clarification and maximum solids concentration. Solid-bowl centrifuges are described. Machine and process variables are discussed. Machine variables include: bowl design with length to diameter ratio and bowl angle; bowl speed; pool volume (depth); conveyor speed; and pitch. Process variables include feed rate, solids character with particle size and density, feed consistency, temperature, and chemical aids. Recovery is improved by increasing bowl speed and decreasing conveyor speed. A test program was run on raw primary and secondary digested and undigested sludge, pulp and paper wastes, and water softening sludges. Centrifugation increased solids concentration to 53-57% and recovery 79-93% for water softening waste. Recovery-concentration data on tested wastes are tabulated. Centrifugation advantages are listed. (Nardozzi-AWWARF) W72-10931

RECOVERY OF WATERWORKS SLUDGE, Tabriz Water Supply (Iran).

I. Vahidi, and P. C. G. Isaac.

Journal of the Institution of Water Engineers, Vol. 14, No. 6, p 454-458, October 1960. 2 ref.

Descriptors: *Centrifugation, Costs, *Sludge treatment, Waste water treatment, Water treatment, Recycling.

Identifiers: *Alum recovery, Aluminoferic, Aluminum hydroxide, Sulfuric acid, Drying beds.

A laboratory investigation of alum recovery from water works clarification sludges is described. The purification sludge includes aluminum hydroxide, peat, algae, silt, and organic matter. The acidification of insoluble aluminum hydroxide recovers an alum solution and greatly reduces settling time and final volume of the settled sludge. Part of the precipitated organic color and iron salts can be built up in the recovered solution. In the laboratory, a 1.5-2.5% sludge solution was acidified and centrifuged. The centrate, reclaimed alum, was used for coagulation. A 60-65% recovery at pH had the best relative efficiency. An average yield of 1.5 tons of aluminoferic (14% Al₂O₃) is produced for consuming one ton of 98% sulfuric acid. This wet alum recovery process reduces sludge volume for disposal. Costs are considered. The total treatment includes: transporting 1.5-2.5% sludge solution to collection tanks; acid-treatment system; recovered alum separation by centrifugation; pumps, piping, and valves for recirculation of recovered supernatant; solution-storage tanks; and drying beds for the remaining sludge. (Nardozzi-AWWARF) W72-10932

VIRUS REMOVAL—WATER AND WASTE-WATER,

Tennessee Univ., Knoxville. Water Resources Research Center.

For primary bibliographic entry see Field 05D.

W72-10933

HYGIENIC FEATURES OF NEMATOCIDE-NEMAGON IN CONNECTION WITH SANITARY PROTECTION OF WATER BODIES, (IN RUSSIAN),

Moskovskii Gosudarstvennyi Meditsinskii Institut (I) (USSR). Dept. of Public Hygiene.

For primary bibliographic entry see Field 05G.

W72-11055

PUBLIC HEALTH SERVICE DRINKING WATER STANDARDS—1962.

Public Health Service, Rockville, Md.

For primary bibliographic entry see Field 05G.

W72-11076

SG. Water Quality Control

SOLID WASTE MANAGEMENT IN CENTRAL NEW YORK, A REVIEW OF PLANNING AND COMMUNITY EDUCATION,

Cooperative Extension Mid-New York Project, Syracuse, N.Y.

For primary bibliographic entry see Field 06B.

W72-10491

ENVIRONMENTAL POLLUTION AND TEXAS LAW,

Texas Univ., Austin. Science Education Center.

D. R. Stronck.

Texas Journal of Science, Vol 23, No 3, p 439-445, February 1972. 9 ref.

Descriptors: *Water law, *Water pollution control, *Air pollution, *Political constraints, *Texas, Federal government, Economic feasibility, Social aspects, Legislation, Environmental effects, Regional analysis.

The effects of pollution are usually regional. Our air and water can no longer carry in dilution the pollutants which are now being discharged. These pollutants have been rapidly rising in volume because the population is rising and becoming more industrialized and urbanized. Air pollution is the most serious and pressing pollution problem. The greatest problem of present federal air quality standards is that they are not based on an understanding of the chemical nature of the atmosphere. While direct regulation remains rather ineffective, the federal government is tending to provide increasing subsidies and payments to polluters as an incentive to improve their waste management practices. Pennsylvania and Texas are the only major industrialized states that do not grant tax incentives for the installation of pollution abatement equipment. The state of Texas has several laws designed to prevent pollution. These include the Criminal Water Act, the Clean Air Act and the Water Quality Act. The pollution control boards which this legislation has created are composed of citizen volunteers and have no powers beyond requesting the Attorney General to prosecute. A new bill has been introduced into the state legislature that will allow individual citizens to sue polluters. The public is now demanding the enactment and rigid enforcement of stronger pollution control laws but the people will ultimately have to pay for this enforcement in higher taxes. (Casey-Arizona) W72-10517

AGRICULTURE'S CONTRIBUTIONS TO THE NATION'S WATER RESOURCES AND FLOOD CONTROL,

Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.

For primary bibliographic entry see Field 03F.

W72-10520

ROLE OF PLANTS IN IMPROVING THE ENVIRONMENT,

Connecticut Agricultural Experiment Station, New Haven.

For primary bibliographic entry see Field 03F.

W72-10521

A MANUFACTURER'S RESPONSIBILITY FOR NATURAL RESOURCES,

Australian Paper Manufacturers Ltd., Melbourne (Australia).

J. D. Brooks.

Ecological Society of Australia, Proceedings, Vol. 5, p 77-80, 1970.

Descriptors: *Industrial wastes, *Industrial water, Water pollution sources, *Pulp and paper industry, Environmental effects, Planning, Social aspects, Public rights, Psychological aspects, Water reuse.

It is feared that there is a strong tendency in Australia to punish individuals and industry for environmental pollution while excusing public and government pollution. Nevertheless industry has a share of responsibility and an attempt is made to define this responsibility. The particular importance of water conservation is stressed. The difficult and obvious water-use problem is disposal, without upsetting the environment, of used and degraded water-domestic sewage, industrial and agricultural wastes. The other big renewable industrial resources are wood and crops. Paper manufacture should make the greatest possible use of by-product wood from the sawmilling industry and of waste paper. Industry should: (1) very carefully assess its needs and capabilities in light of available resources; (2) concentrate much energy and research into improving use and reuse efficiencies; (3) attempt to educate the entire community into shouldering its share of the environmental responsibility and to resolve its problems by rational action. (Casey-Arizona) W72-10527

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control—Group 5G

ECONOMICS OF WATER POLLUTION CONTROL FOR CATTLE FEEDLOT OPERATIONS, Texas Tech Univ., Lubbock. Dept. of Agricultural Economics.

T. R. Owens, and W. L. Griffin.

In: Proceedings Eighth Industrial Water and Wastewater Conference, June 6-7, 1968, Lubbock, Texas, p 82-106. 10 tab.

Descriptors: *Farm wastes, Cattle, Feed lots, Economics, Runoff, Rainfall, Design, Costs, Water pollution control.

Identifiers: *High Plains.

One approach to the problem of water pollution from feedlots involved control of runoff by establishing collection basins and subsequently pumping the pollutant to an open land disposal area. A second suggested solution was a collection basin of sufficient size to hold polluted runoff until natural evaporation emptied the system. Data from secondary sources were used to develop the relationship between inches of precipitation and resultant runoff. Subsequently, design criteria were developed for various sizes of mechanical discharge and evaporative discharge collection systems. The various design criteria were then applied to three different sizes of feedlots, a 5000 head lot, a 10,000 head lot and a 25,000 head lot. Budgets were developed for each lot and for each system size and type, and total capital and annual operating costs were computed. The studies assumed that a part of the cost of operating any particular system would be the penalty imposed for overflow on the basis of current law, this penalty ranges from a minimum of \$50/day to a maximum of \$1000/day. The analysis of rainfall data provided an estimate of the number of overflows expected with any size and type of system. Thus, the cost of overflow was quantified by multiplying the number of overflows by the appropriate penalty rate. Finally, minimum cost systems providing only minimum overflow protection were compared with higher cost systems providing maximum overflow protection. Cost differences between the two systems were then evaluated to determine the increase in annual operating costs associated with additional protection. (Bundy-Iowa State) W72-10536

STATE AGENCIES REGULATING CONFINED ANIMAL FEEDING OPERATIONS, Environmental Protection Agency, Washington, D.C.

J. M. Sweeten.

Environmental Protection Agency Division of Technical Operations Open-File Report (TO 01.0 .543/1) 1971. 37 p.

Descriptors: *Farm wastes, Federal Government, *State Governments, Regulation, Control, Feed lots, Standards, *Administrative agencies.

Identifiers: *Regulatory control.

State Agencies that regulate livestock feeding operations and their responsibility with respect to environmental problems are identified. The reader will thus know which agencies should be contacted about establishing a confined feeding operation, improving or expanding existing feeding facilities, and reporting nuisances arising from feedlots. The information was collected by sending a letter to each State solid waste planning agency requesting: (1) the name and address of all State agencies that should be contacted prior to establishing a confined feeding operation; (2) the types and limits of control exercised by these agencies. The types of agencies exerting regulatory control over animal feeding operations in each State are summarized in a table. The availability of technical assistance in designing feedlot and waste treatment systems is included when specifically mentioned by the respondent agencies. General observations regarding nationwide control over animal feeding operations are made. (Bundy-Iowa State) W72-10538

TEMPERATURE PREDICTION IN STRATIFIED WATER: MATHEMATICAL MODEL-USER'S MANUAL. Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics. For primary bibliographic entry see Field 05B. W72-10547

GEOOTHERMAL RESOURCES IN CALIFORNIA—POTENTIALS AND PROBLEMS, California Inst. of Tech., Pasadena. Environmental Quality Lab.

For primary bibliographic entry see Field 06G. W72-10550

ANALYSIS OF THE EFFECT OF POTENTIAL REACTOR COOLING PONDS ON THE HANFORD GROUNDWATER SYSTEM, Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.

For primary bibliographic entry see Field 05C. W72-10552

THERMAL WATER MAY BE A MARKETABLE BYPRODUCT, Vitro Corp. of America, New York. Agro-Engineering Div.

For primary bibliographic entry see Field 03C. W72-10553

SURVEY OF THERMAL RESEARCH PROGRAMS SPONSORED BY FEDERAL, STATE, AND PRIVATE AGENCIES (1970), Oak Ridge National Lab., Tenn.

G. U. Ulrikson, and W. G. Stockdale. Available from the National Technical Information Service as ORNL-4645, \$3.00 in paper copy, \$0.95 in microfiche. March 1971. 56 p, 9 ref. W-7405-eng-26.

Descriptors: Surveys, Beneficial use, Cooling towers, Model studies, Limnology, Ecology, Temperature, Thermal pollution, *Research and development, *Projects.

Identifiers: *Thermal research, Bioeffects.

A survey was made of state and federal agencies and those colleges and universities with known programs in the field of ecology or oceanography. The projects are divided into nine main categories: Productive Uses, Bio-Effects, Limnological Effects, Combination and General, Cycling Towers, Modeling, Surveys - Ecological, Surveys - Temperature and Physical, Surveys - General. In each category the title of the projects, the location, investigators, sponsor and duration are listed. Each project is numbered for cross indexing with an alphabetical listing of all investigators with addresses in a concluding section. The electric utility industry was not included because of previous documentation in the EEI and AEC surveys. (Upadhyaya-Vanderbilt) W72-10555

A PHENOMENOLOGICAL RELATIONSHIP FOR PREDICTING THE SURFACE AREAS OF THERMAL PLUMES IN LAKES, Argonne National Lab., Argonne, Ill. Center for Environmental Studies.

For primary bibliographic entry see Field 05B. W72-10556

PROBLEMS AND PROSPECTS FOR NUCLEAR POWER, Bechtel Corp., San Francisco, Calif.

For primary bibliographic entry see Field 06G. W72-10557

THE ENVIRONMENTAL CHALLENGE—VALUES IN CONFLICT,

Westinghouse Electric Corp., Philadelphia, Pa. Environmental Systems Dept.

J. H. Wright.

Engineering Issues—Journal of Professional Activities, American Society of Civil Engineers, Vol 97, No PPI, Proc. Paper 8471, p 17-22, October 1971.

Descriptors: *Resource allocation, *Environment, Ecology, Preservation, Natural resources, Water resources, Thermal pollution, Cooling towers, Air pollution, Aquatic life.

Identifiers: Human factors.

The major problem today is the proper allocation and management of natural, human and material resources. The lack of clearcut objectives and methods for assessing relative priorities of primary and secondary goals can lead to considerable misallocation of resources on a national or even worldwide basis. Natural ecological systems have an inherent capacity to withstand, without damage, some level of stress imposed by society's wastes. Therefore the objective of total preservation of the natural environment is as extreme as the objective of maximum production with a total disregard for environmental effects. Environmental deterioration in the industrialized urban center has, in many cases reached alarming proportions. Energy use in the U.S. will nearly triple in the next 30 years and in the year 2000, over 500 million tons of air pollutants will be emitted. The disadvantages of cooling towers are discussed. New applications of discharge heat to processes should be developed in agriculture, aquaculture, and sewage treatment. Intelligent solutions to environmental problems can only be derived from a total systems analysis of those problems. (Upadhyaya-Vanderbilt) W72-10558

COMPUTER MODEL OF CROSSFLOW TOWERS,

Union Carbide Corp., Oak Ridge, Tenn.

J. E. Park, and J. M. Vance.

Chemical Engineering Progress, Vol. 67, No. 7, p 55-57, July 1971, 5 fig, 1 tab, 3 ref.

Descriptors: *Computer models, *Cooling towers, Thermal powerplants, Thermal pollution, Heat transfer, Optimization, Sensitivity, Temperature, Performance.

Identifiers: *Crossflow towers, Data reduction.

The application of the digital computer in determining the number of tower cells required for a cooling application, and for reducing and interpreting test data for crossflow cooling towers has been described. The fundamental equations for the model were derived by Merkel in 1925. The three routines used include a data reduction routine; a comparison of that data to the design conditions, quantifying the decay or, in the case of a rebuilt tower, the possible improvement in performance over the manufacturer's guarantees; and an optimizing routine for a heat rejection system. With a great number of crossflow towers in existence and the fast growing interest in cooling towers as a means of reducing thermal pollution of rivers and lakes, such an application should be of interest to the engineer. (Upadhyaya-Vanderbilt) W72-10559

HOW TO COOL STEAM-ELECTRIC POWER PLANTS,

Westinghouse Electric Corp., Pittsburgh, Pa.

For primary bibliographic entry see Field 05D. W72-10563

HEATED SURFACE JETS IN STEADY CROSS CURRENT,

Federal Water Pollution Control Administration, Portland, Oreg.; and Wisconsin Univ., Madison. Dept. of Civil Engineering.

For primary bibliographic entry see Field 05B. W72-10564

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

HEAT DISPERSAL-LAKE TRAWSPNYDD COOLING STUDIES,
Central Electricity Generating Board (England).
Northwestern Region.
For primary bibliographic entry see Field 05B.
W72-10569

THE RIVER BASIN MODEL: COMPUTER OUTPUT.
Envirometrics, Inc., Washington, D.C.
For primary bibliographic entry see Field 06A.
W72-10574

INTRODUCTION TO: COASTAL ZONE MANAGEMENT: MULTIPLE USE WITH CONSERVATION,
For primary bibliographic entry see Field 06G.
W72-10575

CONSERVATION OF MINERAL RESOURCES OF THE COASTAL ZONE,
California State Lands Commission, Sacramento.
For primary bibliographic entry see Field 06G.
W72-10580

GUIDELINES FOR DEVELOPING COMMERCIAL FEEDLOTS IN KANSAS,
Kansas State Univ., Manhattan. Cooperative Extension Service.
D. B. Erickson, and P. A. Phar.
Kansas State University, Cooperative Extension Service, Number C-418, (April 1970). 30 p, 2 fig, 20 tab, 15 ref.

Descriptors: *Farm wastes, *Feed lots, Cattle, Economics, Irrigation, Feeds, Runoff, Kansas, Cost analysis.

Guidelines are provided on costs of financing and constructing feedlots. The development of large feedlots handling 10,000, 20,000 and 30,000 head has been inspired by economics of scale and very favorable cattle and feed prices. The average investment for a 10,000 head capacity lot would be about \$43.15 per head, while for a 30,000 head capacity lot the requirements drop to about \$33.87 per head. The total feed and operating cost per head for each size feedlot is: 10,000 head - \$85.36; 20,000 head - \$83.89; 30,000 head - \$82.24. The expansion of the large feedlots in Kansas will depend on the availability of feed, water, labor and cattle. Some areas will have the capacity to expand faster than others depending on existing grain production and development of irrigation. Shipping grain a considerable distance adds to cost of production. Knowledge of the number of cattle and hogs to be fed, crop production and the location of the market that will return the greatest income to the cattle owners is necessary for an assessment of the local potential for a feedlot. Expansion of the packing industry areas where feeding is increasing creates a greater opportunity for producers to sell their cattle. (Bundy-Iowa State)
W72-10585

PLANNING ANIMAL WASTE DISPOSAL SYSTEMS,
Oregon State Univ., Corvallis. Cooperative Extension Service.
For primary bibliographic entry see Field 05D.
W72-10586

LIVESTOCK WASTE DISPOSAL AND WATER POLLUTION CONTROL,
Colorado State Univ., Fort Collins. Cooperative Extension Service.
R. W. Hansen.
Colorado State University, Cooperative Extension Service, Bulletin 480a, October 1971. 13 p, 4 fig, 2 tab, 6 ref, append.

Descriptors: *Farm wastes, Feed lots, Cattle, Runoff, Odor, Lagoons, Settling basins, Nitrogen,

Phosphorus, Potassium, Colorado, Waste disposal, Waste water treatment, *Water pollution control.
Identifiers: Controlled runoff, Anaerobic lagoons.

The purpose is to acquaint the feedlot operator and the livestock man with the general requirements for the control of pollution from livestock facilities. Both federal and state agencies are active in developing and implementing controls to enhance environmental quality. These efforts obviously and logically include livestock enterprises. General information is provided on types of systems that may be used to prevent pollution from feedlot runoff. The design of the system should be done by competent engineers. Engineering services are available from the Soil Conservation Service and consulting engineering firms. (Bundy-Iowa State)
W72-10587

GUIDELINES TO LAND REQUIREMENTS FOR DISPOSAL OF LIQUID MANURE,
Guelph Univ. (Ontario).
For primary bibliographic entry see Field 05D.
W72-10589

POLLUTION CONTROL IN CATTLE FEEDLOTS THROUGH USE OF MANURE AS FEED,
Auburn Univ., Ala. Dept. of Animal Science; and Alabama Agricultural Experiment Station, Auburn.

W. B. Anthony.
In: Proceedings Eighth Industrial Water and Wastewater Conference, June 6-7, 1968, Lubbock, Texas, p 59.

Descriptors: *Farm wastes, Confinement pens, Cattle, Feeds, Feed lots, Silage, Grains.
Identifiers: *Fresh manure, Wastelage.

Sanitation for cattle fed in confinement necessitates a satisfactory and economical means of disposing of manure. In initial tests, fresh manure was blended with a concentrate and fed to cattle from which it was collected. The blending ratio was 40 parts of manure and 60 parts of grain. Although the feeding of manure directly to the cattle from which it was collected proved to be not only possible but economically advantageous in terms of improved feed efficiency. Other ways of feeding cattle manure were investigated. The making and feeding of Wastelage evolved. Wastelage is made by combining feedlot manure with grass hay and storing the mixture in a silo. (Bundy-Iowa State)
W72-10590

FARM ANIMAL WASTE DISPOSAL,
Ontario Water Resources Commission, Toronto. Div. of Research.
For primary bibliographic entry see Field 05D.
W72-10595

OVERALL PROBLEMS AND AN APPROACH TO DISPOSAL OF ANIMAL WASTE,
Cornell Univ., Ithaca, N.Y. Dept. of Poultry Science.
For primary bibliographic entry see Field 05D.
W72-10598

THE EFFECTS OF ARTIFICIAL AERATION ON LAKE ECOLOGY,
Michigan State Univ., East Lansing.
For primary bibliographic entry see Field 05C.
W72-10605

THE CARBON DIOXIDE SYSTEM AND EUTROPHICATION,
WARF Inst., Inc., Madison, Wis.
For primary bibliographic entry see Field 05C.
W72-10607

ACID MINE POLLUTION EFFECTS ON LAKE BIOLOGY,
Indiana Univ., Bloomington. Water Resources Research Center.
For primary bibliographic entry see Field 05C.
W72-10610

PLANKTONIC BLUE-GREEN ALGAE: GROWTH AND ODOR-PRODUCTION STUDIES,
North Texas State Univ., Denton. Dept. of Biological Sciences; and Teledyne Brown Engineers, Huntsville, Ala. and East Tennessee State Univ., Johnson City. Dept. of Biology.
For primary bibliographic entry see Field 05C.
W72-10613

DEVELOPMENT OF A STATE EFFLUENT CHARGE SYSTEM,
Vermont Dept. of Water Resources, Montpelier. Agency of Environmental Conservation.
W. Albert.

Copy available from GPO Sup Doc, \$1.75; microfiche from NTIS as PB-210 711, \$0.95. Environmental Protection Agency, Water Pollution Control Research Series, February, 1972. 215 p, 1 fig, 17 ref, 9 append. EPA Program 16110 GNT 02/77.

Descriptors: *Pollution taxes (Charges), *Administration, *Vermont, Economic efficiency, Equity, Legal aspects.

Following passage of legislation authorizing the levying of pollution charges against certain waste dischargers, Vermont's Department of Natural Resources considered several effluent charge systems. These systems included (1) a charge based upon stream damages, (2) a uniform charge to all polluters, (3) a uniform charge weighted by stream classification or zone, (4) a charge based upon dilution factors or population equivalents, (5) a charge based upon stream quality degradation, and (6) a charge based on the annualized cost of treatment. For each of these systems, the issues of incentive effects on dischargers, relation of dischargers to instream economic damages, equity, constitutionality, economic efficiency, technical and administrative feasibility, and income potential are discussed in the context of Vermont law and administrative procedures. The annualized cost-of-treatment charge method, which was chosen by Vermont, receives the most detailed consideration. The administrative efforts undertaken to make the pollution charge method, structure, and schedule operational are also discussed. The appendices include such topics as the estimation of treatment costs; constitutionality considerations of effluent charge systems; the economics of Vermont pollution fees; optimal resource allocation in river quality management; and a summary of water quality standards. (Settle-Wisconsin)
W72-10674

COASTAL ZONE PROCESSES AND THEIR INFLUENCE ON ESTUARIAN CONDITIONS,
Washington Univ., Seattle. Dept. of Oceanography.

A. C. Duxbury.
Available from NTIS as RLO-1725-184, \$3.00 in paper copy, \$0.95 in microfiche. Report No. RLO-1725-184 (Conf. 701064-1), October 28, 1970, 35 p, 17 fig, 9 ref.

Descriptors: *Estuarine environment, *Channel flow, *Water circulation, Mixing, Saline water-freshwater interfaces, Currents (Water), Inflow, Biological communities, Water temperature, Environmental effects, Waste dilution, Bays, Coasts, Ocean currents, Pacific coast region, Pacific Northwest U.S., Turnovers, Path of pollutants.

Flushing of coastal zones may remove waste materials from a semi-isolated embayment, but displace biopopulations or expose them to a lower-temperature, higher-salinity water. Since the

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strength of the tidal currents and topography, combined with the properties of the surface water, enter into the complex flushing process, each embayment is unique and reacts to the whims of nature and man alike. Flushing may be produced by processes that position dense water where it can flow inward to deep estuaries (such as the Strait of Juan de Fuca) or at shallower levels (with Willapa Bay and Gray's Harbor). (Bopp-ORNL)
W72-10676

BUOYANT OIL SLICK RETAINING STRUCTURE.

M. Saavedra.

U. S. Patent No. 3,645,099, 3 p, 9 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 895, No 5, p 1657, February 29, 1972.

Descriptors: *Patents, *Oil spills, *Oil pollution, Pollution abatement, Water pollution control, Water pollution treatment, Separation techniques, *Barriers.

A sequence of elongate panel structures are formed from pliable material. The panels are connected end to end to form a continuous vertical wall that extends around an oil slick. When the panels are subjected to wave action, longitudinally extending portions thereof move vertically without tilting. The structure may be folded in a compact position when not in use. (Sinha-OEIS)
W72-10744

APPARATUS FOR COLLECTING AND CONTAINING OIL ON THE SURFACE OF WATER, Water Pollution Controls, Inc. (assignee).

J. M. Valdespino.

U. S. Patent No. 3,532,219, 3 p, 9 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 879, No 1, p 135, October 6, 1970.

Descriptors: *Patents, *Oil spills, *Oil pollution, *Oil wastes, Water pollution control, Water pollution treatment, Pollution abatement, Separation techniques, Equipment, Flotsam.

The apparatus consists of an elongated tube which may be several thousand feet long and is carried by a reel in flattened condition when not in use. As the tube is unwound from the reel it is attached at spaced intervals to flotation sections which form corners and can be anchored to hold position. Opposite ends of the tube may be joined together to encircle the oil spill. Water and air are introduced into the tube to expand it to full position for required buoyancy. A variety of tanks are connected by a hose to a trap fixed to the tube on the insides. Wave action will force oil and water which have collected in the trap through the connecting hose and will discharge these into the tanks where gravity separation will occur. (Sinha-OEIS)
W72-10750

INSTALLATION FOR RECOVERY OF A LIQUID FLOATING ON WATER SURFACE, D. Chablaix.

U. S. Patent No. 3,529,720, 2 p, 2 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 878, No 4, p 948, September 22, 1970.

Descriptors: *Patents, *Oil spills, *Oil pollution, Pollution abatement, *Separation techniques, Water pollution, Water pollution treatment, Oily water, Oil wastes.

An installation is provided for the recovery of a liquid floating on a surface of water, for example petroleum. It consists of a liquid separation chamber, a pump, and conduit from the pump to the water surface. The installation can be mounted in a boat and several immersed conduits can be connected together by a belt of oil-impervious material positioned around an oil slick. The surface area can be reduced to facilitate intake by the conduits by reducing the perimeter of the belt. (Sinha-OEIS)

W72-10755

METHOD AND APPARATUS FOR PURIFYING WATER, U. E. Bowes.

U. S. Patent No. 3,528,911, 2 p, 2 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 878, No 3, p 737, September 15, 1970.

Descriptors: *Patents, *Water purification, Ponds, Lakes, *Solar radiation, Heat, *Convection, Currents (Water), Water pollution control, Water pollution treatment, Water treatment.

A device heated by the sun is connected to a heat radiator disposed below the surface of a temperature stratified body of water. The connection is established by an insulated heat conductive stem. By radiation and conduction to the adjacent water, the water temperature rises sufficient to cause convective flow upward where it is acted upon by the air and the sun's actinic rays. (Sinha-OEIS)
W72-10756

SEPARATION OF LIQUIDS, National Research Development Corp., London (England). (Assignee).

F. Shuttleworth.
U. S. Patent No. 3,651,944, 3 p, 1 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 4, 1322, March 28, 1972.

Descriptors: *Patents, *Separation techniques, Pollution abatement, *Oil wastes, *Oily water, Water pollution control, Water pollution treatment, Ships, *Oil pollution.

The apparatus consists of a separator vessel with inlets and outlets for the mixture to enter and for the separated components to be discharged. The separator is in the form of a bell or casing having a domed top. Larger globules are separated by flotation. A packed filter bed of polyethylene granules is enclosed in a conical housing where smaller oil globules are entrained when the water flows downward from the primary separating tank. When the oil collected in the first two stages exceeds a certain amount, it is drained or pumped out. (Sinha-OEIS)
W72-10762

SEWAGE DISPOSAL, Underwater Storage, Inc., Washington, D.C. (assignee).

H. G. Quase.
U. S. Patent No. 3,528,462, 3 p, 2 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 878, No. 3, p 634, September 15, 1970.

Descriptors: *Patents, *Sewage disposal, Water pollution control, Pollution abatement, *Detention, *Storage.
Identifiers: Marinas, Pleasure craft.

A simple underwater collection and storage system is described for disposing of sewage from pleasure craft docked by a marina. The force of gravity facilitates sewage removal from small boats. The sewage is stored until it is convenient to dispose of it. (Sinha-OEIS)
W72-10770

METHOD AND APPARATUS FOR SEPARATING IMMISCIBLE LIQUIDS, H. J. Lalonde, and S. I. Lalonde.

U. S. Patent No. 3,527,348, 3 p, 5 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 878, No. 2, p 352, September 8, 1970.

Descriptors: *Patents, *Separation techniques, Pollution abatement, *Oil spills, *Oil pollution, Water pollution treatment, Water pollution control, Water treatment, Oil wastes.

The apparatus consists of a tank with a mixture inlet and oil and water outlets. It has an inclined

baffle plate. The oil-water mixture rotates against the plate in a toroidal fashion so that the oil separates from the water. The oil is thrown toward the top of the tank while the water remains in the compartment. The separated liquids are removed by the specially placed outlets. (Sinha-OEIS)
W72-10776

ADMINISTRATION, SYSTEMS ANALYSIS.

Cornell Univ., Ithaca, N. Y. Dept. of Environmental Engineering.

F. D. Loucks.

Journal Water Pollution Control Federation, Annual Literature Review, Vol 44, No 6, p 990-996, June, 1972. 109 ref.

Descriptors: *Water pollution control, *Waste water treatment, Systems analysis, Planning, Management, Decision making, Simulation analysis, Optimization, Bibliographies.

The role of systems analysis in planning water pollution control policies was reviewed by several writers. Thirty-nine such documents (books, articles, and reports) pertinent to the field of wastewater treatment and water pollution control are summarized. The writings include a broad spectrum of mathematical modeling techniques, such as simulation, linear and dynamic programming, and other optimization methods, to estimate feasible and usually least-cost design and management alternatives for water quality planning. (Bell-Correll)
W72-10779

MICROBIAL DEGRADATION OF OIL, University Coll. of North Wales, Menai Bridge. Marine Science Labs.

G. D. Floodgate.

Marine Pollution Bulletin, Vol. 3, No. 3, p 41-43, March 1972. 1 tab, 13 ref.

Descriptors: *Water pollution effects, *Oil pollution, *Oil, *Biodegradation, *Microbial degradation, *Organic loading, *Waste assimilative capacity, Oily water, Path of pollutants, Organic wastes, Oil spills, Microbiology, Aquatic microbiology.

It is generally assumed that bacteria in the sea can degrade almost anything they are offered, and it is widely believed that petroleum oil is entirely biodegradable. This concept underlies present policies of dispersing polluting oil. There is good reason to suppose that this faith is not well founded and a good deal more will need to be known before we can be certain that polluting oil is not accumulating in the sea. This situation is analogous to radioactivity, where there is a normal background of radiation. The danger arises from overloading the environment, but unlike radiation, the safe level for oil pollution is unknown; hence the need for a more detailed investigation. (LeGore-Washington)
W72-10801

THE BIODEGRADATION OF OIL, University Coll. of North Wales, Menai Bridge. Marine Science Labs.

G. D. Floodgate, C. F. Gibbs, and K. B. Pugh.
Marine Pollution Bulletin, Vol. 2, No. 9, p 143-144, September 1971.

Descriptors: *Water pollution effects, *Oil pollution, *Oil, *Biodegradation, *Microbial degradation, *Research facilities, Analytical techniques, Oily water, Path of pollutants, Organic wastes, Oil spills, Microbiology, Aquatic microbiology.
Identifiers: *Laboratory facilities.

Little is known about the extent and rate of natural biodegradation of oil in the sea. The basic problem in studying this is that of constructing a laboratory system, with individual oil components and pure cultures of bacteria, which realistically mimics the marine environment. Consequently, a laboratory

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model of the marine environment is being constructed to investigate and assess the importance of the biodegradation of oil on the beach and at the sea. (LeGore-Washington)
W72-10802

OIL SLICK DISPERSION METHODS, H. McNeely.

U. S. Patent No. 3,532,622, 2 p., 2 fig., 4 ref.; Official Gazette of the United States Patent Office, Vol. 879, No. 1, p 223, October 6, 1970.

Descriptors: *Patents, *Oil spills, *Oil pollution, Water pollution treatment, Pollution abatement, Separation techniques, Water pollution, *Dispersion, *Waste dilution.

An oil slick on a body of water is dispersed by dividing the oil slick and concentrating the oil on the bow wave created by a boat propelled through the oil slick. At the same time a mixture of water and chemical dispersant is sprayed in high pressure jets which are swept across the bow wave in a cyclic oscillating motion substantially perpendicular to the length of the boat, thus producing a zig-zag spray pattern on the oil slick due to the forward motion to the boat. A near constant angular speed in the oscillatory motion of the jets automatically applies a greater concentration of dispersant adjacent the boat, where the oil is heaviest on the bow wave. The high dilution of the dispersant with environment water increases emulsification and turbulence for increased efficiency. (Sinha-OEIS)
W72-10809

RESEARCH ON DRY-TYPE COOLING TOWERS FOR THERMAL ELECTRIC GENERATION: PART II,

Beck (R. W.) and Associates, Denver, Colo.
For primary bibliographic entry see Field 05D.
W72-10810

DEVELOPMENT AND DEMONSTRATION OF LOW-LEVEL DRIFT INSTRUMENTATION,

Environmental Systems Corp., Knoxville, Tenn.
F. M. Shofner, and C. D. Thomas.
Copy available from GPO Sup Doc. \$0.65; microfiche from NTIS as PB-210 759, \$0.95. Environmental Protection Agency Water Pollution Control Research Series, October 1971. 56 p., 19 fig., 2 tab., 7 ref. EPA Program 16130 GNK 10/71.

Descriptors: *Cooling towers, *Testing procedures, Saline water, Fallout, Thermal pollution, Computers, Design criteria, Instrumentation. Identifiers: *Drift instrumentation, *Plumes, Acceptance testing.

Instrumentation for measurement of low level drift from cooling towers was developed. Emphasis was placed on the Particulate Instrumentation by Laser Light Scattering (PILLS) System which is capable of on-line measurement and, with incorporation of existing pulse height analyzer and mini-computer equipment, complete on-line data production. Complementary techniques of isokinetic sampling (IK) and sensitive paper sampling were developed and field proven. Feasibility was demonstrated for an infrared in-line holocamera system. The design principles and engineering trade-offs for the PILLS, IK, and sensitive paper techniques are described. Drift performance data are given for a small air conditioning cooling tower unit, two large mechanical draft cooling towers, and a natural draft tower. (Eagle-Vanderbilt)
W72-10818

FEDERAL ASSISTANCE SPURS WATER SUPPLY IMPROVEMENTS,

Black and Veatch, Consulting Engineers, Kansas City, Mo.
For primary bibliographic entry see Field 05F.
W72-10821

THE NEED FOR ADVANCE PLANNING OF THERMAL DISCHARGES BEFORE SITE ACQUISITION,

Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.

R. T. Jaske.
Proceedings of the American Power Conference, Vol 31, 1969. 10 p., 3 fig., 8 ref. AEC AT (45-1) 1830.

Descriptors: *Thermal pollution, *Heated water, *Environmental effects, Turbulence, Temperature, Simulation analysis, Sites, Forecasting, Mixing, Planning.

Identifiers: Load factor.

Advance planning of thermal discharges is vital in locating power plants, in particular with respect to the incidental benefit to enhance ecological systems or reduce icing on navigable waters. Assuming that a river is in essence a long cooling pond, the affected river length, L , in miles can be obtained if the average width in feet, average stream velocity in feet per second, plant rating (109 watts), and the coefficient K are known. Generally, impact areas of from 2500 acres to as high as 3500 acres need to be considered for each 1000 MWe. Other factors which should be considered in advanced planning are zone of mixing, both plant load factor and stream load factor, effects of heavy development, effects of turbulence and biological effects. The choice of plant size and cooling method must be carefully weighed in advance if the differences between fuel type or transmission penalties for more favorable locations are equal in magnitude. Long-range planning based on advance simulation of thermal discharges is indispensable to utility operations which seek to fully explain the consequences of their intended actions to be public in a meaningful way. (Upadhyaya-Vanderbilt)
W72-10825

DISCHARGE OF COOLING WATER FROM THERMAL POWER PLANTS (KYLVATTENUT-SLAPP FRAN VARMEKRAFTVERK),

Chalmers Univ. of Technology, Goteborg (Sweden).

For primary bibliographic entry see Field 05B.
W72-10826

TWO-DIMENSIONAL SURFACE WARM JETS,

Tetra Tech, Inc., Pasadena, Calif.

For primary bibliographic entry see Field 05B.
W72-10828

COOLING POND TEMPERATURE VERSUS SIZE AND WATER LOSS,

Environmental Protection Agency, Pacific Northwest Water Lab., Corvallis, Ore.

B. A. Tichenor, and A. G. Christianson.
Journal of the Power Division, American Society of Civil Engineers, Vol 97, No 003, Proc Paper 8250, p 589-596, July 1971. 2 fig., 3 tab., 3 ref.

Descriptors: *Water temperature, *Evaporation, *Water loss, Solar radiation, Energy budget, Electric power, Water consumption, Powerplants, Efficiencies, Cooling water, *Thermal pollution, Costs.

Identifiers: *Cooling pond, *Pond size.

The primary cost for cooling ponds is land; therefore, the economic feasibility of a cooling pond system may be determined by land costs in a specific design area. As with any wet cooling device, cooling ponds incur water losses through evaporation, and the value of this water should be considered in the economic evaluation of the total cooling system. Heat transfer mechanisms involved in pond cooling are considered, pointing out that back radiation, conduction-convection, and evaporation are functions of pond water surface temperature which, in turn, is subject to control through variations in plant design or operating practices. For a given waste heat load to be dissipated, higher cooling pond operating temperatures result in a smaller area requirement and less

evaporative water loss. Curves are presented which show the influence of temperature on pond size and on water loss at selected locations throughout the U.S. Results of a field study, which support the general analysis are also presented. The economic trade off between the value of water and land saved versus increased production cost must be closely evaluated to determine the optimum design for a given situation. (Upadhyaya-Vanderbilt)
W72-10829

CONDENSER COOLING AND PUMPED STORAGE RESERVOIRS,

Main (Chas. T.), Inc., Boston, Mass. Thermal Power Group.

E. Sefchovich.
Journal of the Power Division, American Society of Civil Engineers, Vol 97, No 003, Proc Paper 8247, p 611-721, July 1971. 9 fig., 1 tab., 11 ref.

Descriptors: *Cooling water, *Pumped storage, *Reservoirs, *Lakes, Evaporation, Powerplants, Temperature, Water consumption, Water resources, Wind velocity, *Thermal pollution, Electric power, Efficiencies.

The feasibility of utilizing pumped-storage reservoirs to increase the supplies of cooling water for thermal power plants is investigated. An important parameter in such studies is the determination of the waste heat that can be dissipated by the lake. For illustration purposes a recent thermal site evaluation is described. The proposed impoundment is to serve as the lower reservoir of a 750 Mw pumped-storage facility. The study showed that this lake can dissipate the waste heat from water-cooled nuclear plants with a total capacity of 2,750 Mw. Alternatively fossil-fired stations with a total capacity of 4,100 Mw can be accommodated by the lake. The higher thermal efficiency of fossil-fueled plants is the main reason for this difference. The increase in evaporation rate resulting from these plants can be readily made up by natural inflows. Hence, significant amounts of electricity can be safely generated at the site. (Upadhyaya-Vanderbilt)
W72-10830

NUCLEAR WASTE HEAT TO TREAT MUNICIPAL SEWAGE.

For primary bibliographic entry see Field 05D.
W72-10831

THERMAL EFFECTS - PROBLEMS, SOLUTIONS,

Electric Thermometer, Trinity, Inc., Bridgeport, Conn.

E. Umrath.
Power, Vol 115, No 5, p 82-83, May 1971. 1 fig.

Descriptors: *Water quality standards, *Temperature, Heated water, Measurement, *Thermal pollution, Lake Michigan, Sampling.

Identifiers: Temperature rise.

There is no single code governing thermal effects that is applicable in all states. The general limit for inland waters, 5F above the normal monthly average, allowing maximums of 86 to 96F for short periods in different parts of the country, is criticized. It is quite probable that even under normal diurnal variations for a given time of the year, actual water-source temperatures have a high or low temperature differential considerably in excess of 5F even though the limitation of 5F above normal is met. The proposal setting a 1F maximum temperature rise in cooling water discharge into Lake Michigan is incomplete and is subject to misinterpretation. It is difficult to say whether 5F increase in natural temperature is or is not injurious to the ecology if in one case the differential measurement is based on surface temperature and in another case on bottom temperature. The availability of platinum RTD sensors permits measurements of changes in temperature and stratification

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control—Group 5G

measurements for comprehensive thermal analysis. (Upadhyaya, Vanderbilt)
W72-10832

DEEP TUNNELS IN HARD ROCK.
Wisconsin Univ., Milwaukee. Coll. of Applied Science and Engineering.

Copy available from GPO Sup Doc as EP2.10:11020-02/71, \$1.75; microfiche from NTIS as PB-210 854, \$0.95. Proceedings of an engineering institute, Wisconsin University, Milwaukee, November 9-10, 1970. Environmental Protection Agency, Water Pollution Control Research Series, February 1971. 221 p, 92 fig, 5 tab, 17 ref. EPA Program 11020 02/71.

Descriptors: *Tunneling, *Rock excavation, *Combined sewers, *Tunneling machines, *Underground storage, *Overflow, Tunnel construction, Storage, Sewerage, Flood control, Water pollution control, Urban runoff, Pumped storage, Nuclear powerplants, Urbanization, Underground powerplants, Storm drains, Multiple-purpose projects, Water management (Applied), Aquifer management, Waste water treatment, Sanitary engineering, Rock mechanics.

Identifiers: *Deep tunnels, *Combined sewer overflows, Chicago, Metropolitan Sanitary District of Greater Chicago.

An institute was held to discuss tunneling in hard rock, deep below ground surfaces. The goals were to: describe tunneling experiences in Chicago, western United States, Canada, and Europe; discuss some of the multiple-use aspects of deep tunnels; assess the future of rapid excavation in hard rock using mining machines; and encourage those facing combined sewer and flooding problems to assess the potential use of tunnels. The flooding and combined-sewer overflow problem is discussed, as are the investigations and plans of the Metropolitan Sanitary District of Greater Chicago for constructing a deep tunnel system to alleviate flooding and pollution from combined-sewer overflows. The potential of pumped-storage hydroelectric power generation and circulation of condenser water from underground nuclear generating plants, in conjunction with tunnel construction, is treated. Experiences with mechanical moles in the United States and other countries in boring through hard rock are described. Suggestions are given concerning pre-construction investigations, planning and design that can minimize field problems, expedite tunneling procedures, and reduce tunneling costs. Various viewpoints are presented including those of the contractor, machine manufacturer, tunnel designer, utility company, geologist, and public agency. Eleven papers are included in this publication, compiled under the supervision of Professors Vinton W. Bacon and Paul A. Seaburg. (See W72-10835 thru W72-10845) (Poertner)
W72-10834

THE FLOODING AND COMBINED SEWER OVERFLOW PROBLEM IN URBAN METRO AREAS.
Wisconsin Univ., Milwaukee. Dept. of Civil Engineering.
V. W. Bacon.

In: Deep Tunnels in Hard Rock. Proceedings of an engineering institute, November 9-10, 1970, University of Wisconsin, Milwaukee, p 3-7.

Descriptors: *Combined sewers, *Overflows, *Sewerage, *Flood control, *Water pollution control, *Tunnels, Storage, Separated sewers, Storm drains, Cities, Urbanization, Water quality control, Sewers, Alternative planning, Pollution abatement, Investigations, Surface runoff, Urban runoff, Urban hydrology, Waste water disposal. Identifiers: *Combined sewer overflows, Deep tunnels.

Statistics are cited concerning combined-sewer problems in urban areas of the United States, and

potential solutions to these problems are stated. It is estimated that in the U. S. there are 36 million persons in 1,329 jurisdictions, served in whole or in part by combined sewers. It is estimated that about 30 percent of the total pollution material entering combined sewers overflows into receiving waterways. The combined sewer overflow problem can be solved in one of three ways, or a combination of the three. First, combined sewers can be separated; that is, a second sewer can be constructed in the street. APWA estimates that, if all jurisdictions were to solve the problem through separation, the total expenditure would approximate \$30 billion, and to make the necessary changes in and on private property to effect total separation would increase this total cost to approximately \$48 billion. The probability appears remote that separation will be selected as a solution by many jurisdictions. A second possible solution involves interception of sewage flows and treatment at overflow points. A third, and more attractive solution, is the use of underground conveyance tunnels and storage caverns, carved into rock strata, for temporary storage of combined-sewer overflows and subsequent treatment after being pumped back to the surface. Boston and Chicago have made detailed studies of the latter concept and concluded that this solution should be adopted in their jurisdictions. (See also W72-10834) (Poertner)
W72-10835

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO EXPERIENCES AND FUTURE PLANS FOR HARD ROCK TUNNELS.
Metropolitan Sanitary District of Greater Chicago, Ill.

F. C. Neil.

In: Deep Tunnels in Hard Rock. Proceedings of an engineering institute, November 9-10, 1970, University of Wisconsin, Milwaukee, p 9-30. 10 fig.

Descriptors: *Combined sewers, *Overflow, *Tunnels, *Sewerage, *Underground storage, Flood control, Water pollution control, Tunneling, Tunneling machines, Rock excavation, Lake Michigan, Illinois, Separated sewers, Storm drains, Cities, Urbanization, Storage, Water quality control, Sewers, Pollution abatement, Urban runoff, Waste water disposal, Waste water treatment.

Identifiers: *Chicago, *Metropolitan Sanitary District of Greater Chicago, *Combined sewer overflows, Deep tunnels.

The Metropolitan Sanitary District of Greater Chicago is a municipal corporation serving 5,500,000 persons living within a 860-square mile area in Cook County, Illinois. There are approximately 118 municipalities, including the City of Chicago, and 30 sanitary districts under its jurisdiction. The Metropolitan Sanitary District has proposed a \$2 billion-dollar, ten-year program to meet the water quality standards and permit higher uses of the waterways. In the City of Chicago and older suburbs, there are over 300 square miles served by combined sewers. The greatest number of the 400 overflow points from combined sewers discharge directly to the canal system. Use of canal water is generally restricted to cooling water due to the poor water quality. The cost of separation of sewers would be over \$4 billion-dollars. Disruption of the community and loss of business during the construction would add considerable expense to this figure. Based on present knowledge of storm runoff from urban areas it is doubtful if separation would sufficiently improve the quality of the waterways to meet standards.

The plans of the Sanitary District for providing solutions to flooding and water pollution from combined sewers are explained. The solution involves the construction of large diameter tunnels in rock strata several hundred feet below the ground surface. The tunnel system which will provide both conveyance and storage of overflows is an alternative to sewer separation and the construction of additional sewers in existing sewer-

areas. The cost is estimated to be about 25 percent of that of separation. (See also W72-10834) (Poertner)
W72-10836

THE ROLE OF STORAGE IN ECONOMICS OF SEWAGE TREATMENT PLANT DESIGN,
Bauer Engineering, Inc., Chicago, Ill.

W. J. Bauer.
In: Deep Tunnels in Hard Rock. Proceedings of an engineering institute, November 9-10, 1970, University of Wisconsin, Milwaukee, p 33-48. 6 fig.

Descriptors: *Storage, Construction costs, *Waste water treatment, *Combined sewers, *Overflow, *Underground storage, Rock excavation, Sewage treatment, Sewers, Sewage systems, Sewerage, Treatment facilities, Capital costs, Comparative costs, Design flow, Sanitary engineering, Economics, Illinois.

Identifiers: *Sewage treatment plants, *Chicago.

The economics of sewage treatment plant design is examined using volume-of-storage as an independent variable. Six figures are discussed to explain the positive economic benefits of temporary storage of sewage flows, particularly in combined sewers during periods of stormwater inflow. It is shown that a given degree to treatment can be provided more economically at lower influent flow rates and that superior treatment results at lower inflow rates. An example, to illustrate beneficial effects of storage, shows that a 15 mgd plant with 7 million gallons of storage could operate with the capacity of a 20 mgd plant without storage facilities. Storage is also shown to reduce the cost of transporting sewage, particularly in long sewer systems. Capital costs are compared for a plant of 30 mgd capacity, with and without storage. With 26 million gallons of storage, the plant and storage facilities would cost \$19.6 million compared to \$24 million without storage. In addition to economic benefits, plant performance is improved, the flow into receiving streams is being regulated, and the storage facility can be used for dumping plant inflow during breakdown periods. The need for aeration of stored combined sewage is mentioned, as well as the need for solids handling facilities including bottom scraping mechanisms and pumps. Implementation of storage in new plant construction and old sewers is recommended to gain higher utilization of facilities. (See also W72-10834) (Poertner)
W72-10837

THE IMPACT OF THE DEEP TUNNEL PLAN ON WATER RESOURCES IN THE CHICAGO AREA,
National Water Commission, Arlington, Va.
V. Koelzer.

In: Deep Tunnels in Hard Rock. Proceedings of an engineering institute, November 9-10, 1970, University of Wisconsin, Milwaukee, p 49-77. 7 fig, 1 tab, 3 ref.

Descriptors: *Water conservation, *Tunnels, *Overflow, *Underground storage, *Combined sewers, *Sewerage, Controlled drainage, Groundwater mining, Water management (Applied), Storage, Sewers, Pollution abatement, Flood control, Lake Michigan, Illinois, Diversions, Aquifer management.

Identifiers: *Chicago, *Metropolitan Sanitary District of Greater Chicago, Combined sewer overflows, Deep tunnels.

The paper describes the impact on both surface water and ground water resources of a deep tunnel project proposed for construction by the Metropolitan Sanitary District of Greater Chicago. The proposed project is designed to provide temporary storage for storm water and its accompanying pollution load. Tunnels and storage areas would be excavated in solid rock at elevations varying from 250 to 800 ft. below ground level. They would hold combined-sewer overflows

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which now floods basements and viaducts and pollutes streams in the area. On cessation of the storm, the stored water would be pumped to the surface and then to the District's treatment plant. After treatment, it would be returned to the rivers and streams of the area. The paper shows that the benefits to conservation of water could be as significant as those originally expected for flood and pollution control. For surface water, it is estimated that the Deep Tunnel Project would, in effect, ultimately make available an additional 513 cfs (332 mgd) for use in the Northeast Illinois, because of better regulation and complete treatment of storm water overflows. The value of this water, when fully used, is estimated to range from \$3.6 million to \$6.0 million annually for each 100 cfs (65 mgd), depending on alternatives. This would justify a capital investment, if staged to meet uses, of \$18 million to \$86 million for each 100 cfs. For ground water, the paper describes elaborate measures planned to protect the aquifers from pollution by the Project. It demonstrates how the Project could serve as a management vehicle to reverse the trend of ground water 'mining' in the metropolitan area. (See also W72-10834) (Poertner)
W72-10838

THE POTENTIAL OF PUMPED STORAGE FOR HYDRO-ELECTRIC GENERATION IN MULTI-LEVEL DEEP TUNNEL SYSTEMS, Harza Engineering Co., Chicago, Ill.

K. E. Sorenson.
In: Deep Tunnels in Hard Rock, Proceedings of an Engineering Institute, November 9-10, 1970, University of Wisconsin, Milwaukee, p 81-91, 5 fig.

Descriptors: *Multiple-purpose projects, *Underground storage, *Combined sewers, *Overflow, *Underground powerplants, Pumped storage, Nuclear powerplants, Flood control, Water pollution control, Hydroelectric power, Project purposes, Institutional constraints, Legal aspects, Cities, Urbanization, Surface drainage, Urban runoff.

Both hydroelectric and nuclear power plants can be valuable complementary functions to the use of the urban underground space for temporary storage of stormwater runoff and sewage from combined sewer overflows. Large underground chambers excavated for urban flood control would have relatively infrequent use, and would very rarely be fully used as single-purpose reservoirs. One possible dual function could be for hydroelectric pumped-storage. Another multi-purpose function could be the circulation of condenser water for underground nuclear generating plants. This paper describes briefly the possibilities and implications of such multi-purpose uses. Underground installations could overcome both the topographical and preservationist obstacles. Nuclear plants also present problems for urban or suburban siting, in some cases due to unwarranted fear by the public of accidental radioactive emissions. Warm water discharges from condensers also have led to opposition. Underground placement of nuclear plants can give assurances of isolation during accidents and greater protection against sabotage. Surface reservoirs of a flood control and pollution abatement scheme might possibly serve also as cooling ponds. The functions of pumped-storage generating plants for daytime peaking and system reserves are best served if located close to load centers. The author describes the principal elements of pumped-storage and nuclear power generation, multipurpose uses of an underground reservoir, costs of multi-purpose versus single-purpose underground flood and pollution control developments, and institutional problems and legal obstacles. (See also W72-10834) (Poertner)
W72-10839

EUROPEAN DEVELOPMENT AND EXPERIENCE WITH MECHANICAL MOLES IN HARD ROCK TUNNELING, Atlas Copco A.B., Stockholm (Sweden).

P. Barendsen.

In: Deep Tunnels in Hard Rock, Proceedings of an Engineering Institute, November 9-10, 1970, University of Wisconsin, Milwaukee, p 93-112, 12 fig.

Descriptors: *Tunneling machines, *Europe, *Rock excavation, Tunneling, Excavation, Mechanical equipment, Tunnel construction, Mining engineering, Construction equipment, Research and development, Shafts (Excavations), Drilling.

Identifiers: *Hard rock tunneling, *Undercutting, Mechanical mole, Cutting tools, European experience.

The rock boring machines available for tunnelling in Europe today, may be divided into two groups, according to the method of operation: Machines that work the full face of the tunnel at any moment, while being advanced continuously along the tunnel axis; and machines with one or more cutter heads of dimensions substantially smaller than the tunnel cross section which work the face by a combined rotating and sweeping movement and are advanced stepwise in the longitudinal direction of the tunnel. The latter machines can, because of their design, cut a tunnel of noncircular cross-section and are, therefore, of special interest in mining operations where a flat footwall is required for haulage purposes. Atlas Copco recently made available a tunnelling machine of the latter type for excavating hard rock, using the undercutting principle. The author concludes that the undercutting principle enhances tunnelling by making possible flexible and economic operations. The advantages of the undercutting principle over the full-face method are: free choice of opening shape; negotiations of tight curves; operating at low thrust with low anchoring forces; use of only one type of tool, independent of rock hardness; and moderate cutting tool costs. Discussion is presented concerning cutting tools, special features of various tunnelling machines applying the undercutting principle, and experiences with four tunnelling machines making circular openings operating on the undercutting principle. (See also W72-10834) (Poertner)
W72-10840

EUROPEAN DEVELOPMENT AND EXPERIENCE WITH MECHANICAL MOLES IN HARD ROCK TUNNELING, Demag A.G., Duisburg (West Germany).

E. Weber.

In: Deep Tunnels in Hard Rock, Proceedings of an Engineering Institute, November 9-10, 1970, University of Wisconsin, Milwaukee, p 131-129, 14 fig.

Descriptors: *Tunneling machines, *Europe, *Rock excavation, Tunneling, Excavation, Mechanical equipment, Tunnel construction, Mining engineering, Construction equipment, Research and development, Shafts (Excavations), Drilling.

Identifiers: *Hard rock tunneling, Mechanical mole, Cutting tools, European experience.

It is estimated that approximately 7,600 miles of headings are driven per annum by the world's underground mining industry. The civil engineering industry would increase this by about 380 miles of canalization, water tunnels and similar projects. The annual cost is estimated to be at least \$1.7 billion. More than 250,000 men are employed worldwide on underground driving operations. The number of accidents occurring during conventional tunnelling and drifting is radically reduced by the employment of fully-mechanized tunnelling equipment. Maintenance of the health and the safety to work of several thousand skilled workers underground is to be welcomed from all points of view. If it is borne in mind that underground mining is taking place at greater and greater depths and higher rock formation temperatures are hence encountered, it may be seen that mechanization also makes the miner's work easier. Brief accounts are given of tunnelling performance in England,

Sweden, Germany, Czechoslovakia, Switzerland, and the United States. During the last 10 years, mechanical tunnelling techniques have become so sophisticated and improved that the economical employment of modern machinery is beginning to gain ground as compared with conventional methods. It is to be anticipated, that in the near future, developments will further shift the economic aspects still more in favor of fully-mechanized driving. Features of tunnelling machines, their operation, problems encountered, economics and performance are discussed. (See also W72-10834) (Poertner)
W72-10841

EXPERIENCE IN EDMONTON CANADA WITH EMPHASIS ON PNEUMATIC CONVEYANCE OF MUCK, Edmonton Water and Sanitation Dept. (Alberta).

C. G. Chrysanthou.

In: Deep Tunnels in Hard Rock, Proceedings of an Engineering Institute, November 9-10, 1970, University of Wisconsin, Milwaukee, p 131-139.

Descriptors: *Tunneling, *Pipelines, *Transportation, *Tunneling machines, *Rock excavation, *Piping systems (Mechanical), Mechanical equipment, Construction equipment, Mining engineering, Research and development, Drilling.

Identifiers: *Mucking, Material handling, Pneumatic conveyors, Material transport, Compressed air, Edmonton.

The City of Edmonton has six tunnelling crews working with seven tunnelling machines for constructing interceptor sewers. An average of 5 1/2 miles of tunnel construction is done annually. Sizes vary from 4 feet to 21 feet in diameter. The tunnelling takes place at depths below ground surface varying 50 feet to 180 feet. In small diameter tunnels, below 10 feet, the handling and removal of excavated muck is a difficult and critical matter. Descriptions are given of experiences in using pneumatic conveyors for conveyance of muck. Limitations and operational problems are cited. The author states that the pneumatic conveyance system should not be considered if there is any chance of encountering wet clays or quicksand in the course of the excavation. The application of the pneumatic system is limited by the diameter of the tunnel. Where switching systems and double tracks can be installed, the conventional method of materials handling is still more economical. The system can best be used in a hard rock formation trailing a hard rock machine. The pneumatic system is ideally suited for free flowing materials such as rock cuttings, gravel or sandstone. The nearly uniform size of the materials excavated by the hard rock machine would eliminate any feeding problems. Though an abrasion problem may develop, the material should be more predictable and easier to adapt to. (See also W72-10834) (Poertner)
W72-10842

GEOLOGIC EXPLORATION FOR CHICAGO LAND AND OTHER DEEP ROCK TUNNELS TO BE CONSTRUCTED BY MECHANICAL MOLES, Dames and Moore, Park Ridge, Ill.

G. E. Heim, R. W. Mossman, and H. Lawrence.

In: Deep Tunnels in Hard Rock, Proceedings of an Engineering Institute, November 9-10, 1970, University of Wisconsin, Milwaukee, p 141-173, 17 fig, 2 tab, 4 ref.

Descriptors: *Geologic investigations, *Tunneling, *Hydrogeology, *Tunneling design, *Rock excavation, *Groundwater pollution, Water pollution control, Tunnel machines, Mining engineering, Mechanical equipment, Rock mechanics, Borehole geophysics, Logging (Recording), Exploration, Subsurface investigations, Seismic studies.

Identifiers: *Deep tunnels, *Chicago.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control—Group 5G

The subsurface geological exploration program performed in 1967 and 1968 for the Chicagoland Deep Tunnel Project is described. The Deep Tunnel concept consists of interception of the combined sanitary and storm water overflow at the overflow points, conveyance of the overflow water in tunnels to a mined room and pillar-type storage area from which the overflow water can be pumped at a reduced rate to permit treatment of all waste water. The exploration program included seismic surveying, geophysical borehole logging, test drilling and laboratory testing, and ground-water drilling and testing. The geologic criteria required for the Deep Tunnel Project as set forth in earlier planning studies included the following: (1) rock strata of adequate thickness for the tunnels or the mined storage area; (2) rock capable of providing long term stability with a minimum of supports; (3) uniform rock characteristics desirable for excavation by mechanical moles; (4) a minimum of water problems from groundwater inflow; and (5) protection of the groundwater resources from contamination by outward seepage of the storm water from the tunnels. The tunnels should be located in structurally sound and uniform rock strata with a minimum of potential ground water problems. Ground water conditions must be carefully evaluated for unlined tunnel projects. (See also W72-10834) (Poertner) W72-10843

THE CONTRACTORS VIEWPOINT OF THE HARD ROCK MECHANICAL MOLE—WHAT'S CAUSING DOWNTIME. WHAT DO THEY WANT?

Mining Consultant, Salt Lake City, Utah.

V. L. Stevens.

In: Deep Tunnels in Hard Rock, Proceedings of an Engineering Institute, November 9-10, 1970, University of Wisconsin, Milwaukee, p 175-186, 10 fig.

Descriptors: *Tunneling, *Tunneling machines, *Rock excavation, *Geologic investigations, *Tunnel design, Tunnel failure, Tunnel linings, Tunnel construction, Rock mechanics, Gunit, On-site investigations, Geological surveys, Project planning.

Identifiers: *Downtime, *Construction costs, *Muck removal, Ground support methods, Hard rock tunneling, Moles.

The principal causes for downtime in the construction of tunnels using mechanical tunneling machines (moles) are discussed. Mechanical moleing can be broken down into four basic categories, namely: (1) determination of ground conditions ahead of moleing; (2) the Mechanical Mole itself; (3) muck removal from the tunnel and transportation of men and supplies; and (4) ground support methods (both temporary and permanent). Ground conditions ahead of moleing is the one feature that the tunnel contractor needs the most help in to save valuable down time and extremely high costs. These conditions could be fault zones, running ground water, gas, or heaving ground. Three specific tunneling projects where unexpected ground conditions were encountered are described: (1) the Oslo Tunnel of the San Juan Chama Project in Colorado; (2) the Azotea Tunnel of the San Juan Chama Project; and (3) the water-hollow tunnel job of the Central Utah Project at Strawberry. The author expresses his opinion that all the stated examples could have been determined ahead of time with adequate geological and geophysical examination and determination. If the conditions were determined ahead of moleing the contractor would have been better prepared to cope with the problems, saving considerable time and money. Muck removal causes the greatest overall delay in tunnel moleing. The appropriate choice of ground support methods is dependent upon ground conditions. The author suggests that a continuous method of applying shotcrete at the molehead be developed. Suggestions are also presented for improvements in the design of the mole itself and standardization of tunnel sizes. (See also W72-10834) (Poertner) W72-10844

RAPID EXCAVATION IN HARD ROCK: A STATE-OF-THE-ART REPORT

Bureau of Mines, Minneapolis, Minn. Twin Cities Mining Research Center.

W. E. Bruce, and R. J. Morrell.

In: Deep Tunnels in Hard Rock, Proceedings of an Engineering Institute, November 9-10, 1970, University of Wisconsin, Milwaukee, p 187-219, 11 fig, 2 tab, 10 ref.

Descriptors: *Tunneling, *Tunneling machines, *Rock excavation, *Construction equipment, *Construction costs, Project post-evaluation, Mechanical equipment, Excavation, Tunnel construction, Mining engineering, Tunnels, Safety, Drilling, Rock mechanics, Evolution.

Identifiers: *Tunneling techniques, State-of-the-art.

This paper describes the evolution of present day tunnel boring techniques. Emphasis is directed toward selected cases from the past decade which are discussed in some detail. The data presented has, in many cases, been generated by Bureau of Mines personnel during on-site studies of the particular job.

Twelve tunnels have been machine-bored in the United States since 1955 in rock of over 20,000 psi compressive strength. Significant problems and accomplishments are discussed. Trends in tunneling construction are stated. One-half of these operations were performed in a manner superior in both the speed of boring and the quality of the opening, to conventional drill and blast methods. The other one-half were either partially successful or failures, and the machine had to be replaced by conventional methods. Boring machines have been making steady improvement in their ability to bore hard rock, and some recent tunnels have been successfully bored in rocks of up to 30,000 psi compressive strength with maximum advance rates of up to 1,500 ft./mo. About 188,000 miles of hard-rock tunnels with an excavated volume of about 4.4 billion cu. yd. are expected to be built during this decade in the 18 nations that submitted reports to the 1970 Conference on Tunneling organized by the Organization for Economic Cooperation and Development (OECD). (See also W72-10834) (Poertner) W72-10845

Identifiers: *Downtime, *Construction costs, *Muck removal, Ground support methods, Hard rock tunneling, Moles.

THE OPERATIONAL CAPABILITIES OF THE PROPOSED AIR DELIVERABLE ANTI-POLLUTION TRANSFER SYSTEM (ADAPTS) - VOLUME II: DOCUMENTATION OF THE SIMULATION MODEL, BAGSIM.

Coast Guard, Washington, D.C. Office of Operations.

Available from the National Technical Information Service as AD-731 807, \$3.00 in paper copy, \$0.95 in microfiche. May 1970. 70 p, 2 fig, 6 tab, 3 ref.

Descriptors: *Model studies, *Computer models, *Oil spills, *Oil pollution, *Water pollution control, Documentation, Operations research, Oceans, Ships, Aircraft, Harbors, Coasts, Coast Guard regulations, Transportation, Water pollution.

Identifiers: *Coast Guard, *Tankers, Shipping, Aircraft support.

A system of aircraft deliverable equipment and people is being developed by the U. S. Coast Guard to prevent oil from being spilled from stranded, or distressed, tankers. The system is named the 'Air Deliverable Anti-Pollution Transfer System' (ADAPTS). The effectiveness of the system is measured by the amount of oil that can be transferred from a tanker to floatable bags in 24 hours. The equipment that ADAPTS requires on scene is comprised of rubber bags (called bag packages) which are packaged to be air delivered and dropped by C-130 aircraft, and pump and prime mover sets (called pump or E pkgs.) which are also dropped by C-130 aircraft. These packages are used at the scene of an oil pollution incident before a major spill can occur or during the spill to minimize the spill. An assumption was

made that a four man salvage team with personnel support equipment was needed for each pump used. Transportation of the equipment and personnel is provided by C-130 aircraft from Elizabeth City Air Station (ECAS) and by HH-52A or HH-3F helicopters from the air stations nearest the incident. The study was conducted to discover the upper bound on the capability of the system. The deployment of ADAPTS is a queuing problem. The simulation model developed in the study is GPSS-360/Version 2, a block command oriented language with special blocks for queuing problems. Verification of the BAGSIM model was done by making comparative runs against the ADAPTS problem solutions by PERT/CPM techniques. Details of the computer program and simulation model runs are given. (Poertner) W72-10847

A SUMMARY OF WATER POLLUTION CONTROL IN THE STATE OF TEXAS.

Texas Water Quality Board, Austin.

For primary bibliographic entry see Field 06E.

W72-10856

BEST COMBINATION OF WASTE TREATMENT AND SPATIALLY DISTRIBUTED DISCHARGE OF EFFLUENT.

Rutgers - The State Univ., New Brunswick, N.J. Dept. of Chemical Engineering; and Rutgers - The State Univ., New Brunswick, N.J. Dept. of Biochemical Engineering.

For primary bibliographic entry see Field 05D.

W72-10851

TOPLYR-II A TWO-DIMENSIONAL THERMAL-ENERGY TRANSPORT CODE,

Hanford Engineering Development Lab., Richland, Wash.

For primary bibliographic entry see Field 05B.

W72-10852

RADIOECOLOGY APPLIED TO THE PROTECTION OF MAN AND HIS ENVIRONMENT (SUMMARY).

European Communities, Luxembourg. Commission.

For primary bibliographic entry see Field 05B.

W72-10946

THE EFFECT OF IRRIGATION AND NITROGENOUS FERTILIZERS ON THE GROWTH AND GLYCOSIDAL CONTENT OF DIGITALIS LANATA.

Cairo Univ., Giza (Egypt). Faculty of Pharmacy.

For primary bibliographic entry see Field 03F.

W72-10979

ENVIRONMENTAL HEALTH.

For primary bibliographic entry see Field 05C.

W72-11018

COST AND PERFORMANCE OF RETENTION BASINS IN THE TREATMENT OF WET-WEATHER SEWAGE FLOWS.

Nova Scotia Technical Coll., Halifax.

D. H. Waller.

Preprint, presented at 6th International Water Pollution Research Conference, Session 9, Paper No. 18, June 21, 1972. 10 p, 2 fig, 4 tab, 9 ref.

Descriptors: *Storm runoff, *Suspended solids, Biochemical oxygen demand, *Water quality control, Storm drains, Combined sewers, Design criteria, Cost analysis, Screens, Chlorination, Sedimentation, *Waste water treatment, *Storage tanks, *Cost comparisons.

Identifiers: *Retention basins.

Information was obtained about the composition and flow rates of combined sewage and surface runoff from a 168 acre drainage area at Halifax,

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

Nova Scotia. Surface runoff was the major source of combined sewage solids from this area. These findings, which indicated that storm runoff, discharged untreated, could be a significant source of pollution, led to the design and construction of a covered concrete catch basin with a 0.9 million gallon storage volume. The tank was designed to provide treatment by chlorination and sedimentation for combined sewage that is discharged to the receiving water when the tank is filled. The retention tank was also equipped with a trash screen and designed so that the roof beams would be submerged enough when the tank was full to act as skimmers. Analyses showed the separate system produced a total load of 590 lbs suspended solids and 196 lbs BOD per acre per year, while the combined system reduced these loads to 218 and 157 lbs/acre/year respectively. Cost analyses comparing sewer separation to retention basins are also presented. (Lowry-Texas)
W72-11043

A STUDY OF THE EFFECTS OF SOIL MOISTURE STRESS AND FERTILITY LEVELS ON HYDROXYANIC ACID FORMATION IN SORGHUM.
Punjab Agricultural Univ., Hissar (India). Dept. of Soils.
For primary bibliographic entry see Field 03F.
W72-11046

QUANTITATIVE PROCEDURE FOR EVALUATING THE PERFORMANCE OF WATER AND WASTE WATER TREATMENT PROCESSES AT NATURALLY OCCURRING VIRUS LEVELS,
Texas Univ., Austin. Dept. of Environmental Health and Engineering.
For primary bibliographic entry see Field 05D.
W72-11051

HYGIENIC FEATURES OF NEMATOCIDE-NEMAGON IN CONNECTION WITH SANITARY PROTECTION OF WATER BODIES, (IN RUSSIAN),
Moskovskii Gosudarstvennyi Meditsinskii Institut (I) (USSR). Dept. of Public Hygiene.
N. N. Rakhmatulaev.
Giz Sanit. Vol 36, No 3, p 19-23, 1971, Illus, English summary.
Identifiers: *Nemagon, *Nematocide, *Water quality, Biochemical oxygen demand, Hygiene, *Organoleptic properties.

Water solutions of nemagon were highly stable. Judging by its effect on the organoleptic properties of water, the threshold value of the compound was 0.01 mg/l. Concentrations within 3 mg/l have no effect on the biochemical consumption of O₂. The maximum permissible concentration of nemagon is limited by its effect on the organoleptic properties of water and should be set at the level of 0.01 mg/l.—Copyright 1972, Biological Abstracts, Inc.
W72-11055

PUBLIC HEALTH SERVICE DRINKING WATER STANDARDS—1962.
Public Health Service, Rockville, Md.

Available from GPO, Wash, DC 20402-Price \$0.30.
Public Health Service Publication No 956, 1969. 61 p.

Descriptors: *Standards, *Water quality, *Public health, *Potable water, *Governments, Regulation, Control, Water types, Domestic water, Chemical properties, Physical properties.
Identifiers: *Drinking Water Standards (1962).

The drinking water standards in this report were promulgated as Public Health Regulations in the Federal Register. As such they became effective April 5, 1962, as the Standards to which drinking water and water supply systems used by carriers and others subject to Federal quarantine regula-

tions must conform. The Bureau of Water Hygiene of the Environmental Control Administration is responsible for the application of these Standards to all carrier water supplies. These Standards supersede the Public Health Service Drinking Water Standards-1946, as amended in 1956. The new Standards were developed with the assistance of an Advisory Committee appointed by the Public Health Service to revise the Standards of 1946. New sections, such as one on radioactivity, were added and substantive changes were made elsewhere. (Woodard-USGS)
W72-11076

THE MICROBIOLOGY OF TERRESTRIAL CRUDE OIL DEGRADATION,
Cold Regions Research and Engineering Lab., Hanover, N.H.
For primary bibliographic entry see Field 05B.
W72-11077

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

LIMITS ON THE INSTITUTIONAL FRAME OF REFERENCE IN WATER RESOURCE DECISION-MAKING,
Massachusetts Univ., Amherst.
E. R. Kaynor, and I. Howards.
Water Resources Bulletin, Vol. 7, No. 6, p1117-1127, December 1971, 8 ref. OWRR B-018-MASS (1).

Descriptors: *Institutional constraints, *Water resources, *Decision making, *Massachusetts, Institutions, Attitudes, Social values, Social aspects, Planning, Analytic techniques.

Identifiers: *Water resource decision making, *Decision process, Incremental theories, Side-effect theories, Value-orientations, Established fee system, Goals.

Study of water resource decision-making in Massachusetts demonstrates the existence of many institutional constraints such as the established fee system for consulting engineers, the funding of certain agencies, the institutionalization of equity concerns, overrepresentation of interests, and incompatibility of agency goals. These institutional constraints are attributable in part to certain broadly-based value-orientations such as the American pragmatic tradition. However, evidence indicates that these constraints are less important than other factors in the etiology of decision outcomes. The outcomes of the decision process were found to be at variance with the decision studied, a fact leading to the conclusion that choice of decisions for study should be given more attention. Institutional constraints are important if one is interested in studying how decisions are made, but what actually happens in the long run cannot be easily ascertained by studying either institutions or the decision-making process. More research utilizing the incremental theories of Carl Lindblom and the side-effect theories of Albert O. Hirschman is needed. (Davis-Chicago)
W72-10476

THE RIVER BASIN MODEL: COMPUTER OUTPUT.
Environmetrics, Inc., Washington, D.C.

Copy available from GPO Sup Doc EP2.10:16110 FRU 12/71-12, \$2.00; microfiche from NTIS as PB-210 703, \$0.95. Environmental Protection Agency, Water Pollution Research Series, December, 1971. 246 p, 88 fig, 1 append. EPA Program 16110 FRU 12/71-12.

Descriptors: *Systems analysis, *Computer models, *Computer programs, *SIMULATION ANALYSIS, *Mathematical models, *Regional

analysis, *Decision making, *Resource allocation, *Land use, *Water users, *Water demand, *Water pollution control, Effects, Treatment.
Identifiers: *Computer output, *Gaming simulation.

The River Basin Model is a man-machine simulation model used to delineate the interactions taking place, within a real or hypothetical area, between the local water system and the economic, social, and governmental activities of that area; it is a model of an entire regional system with water as a subsystem realistically interacting with all the other major subsystems, such as transportation and housing. A gaming format is employed, and Model users provide inputs to the computer programs which simulate the major processes. The functions of the computer are presented, and the computer printed output is described in detail. The computer stores and updates all relevant statistics for the area, simulates the actions of the outside systems (such as a national business cycle), and performs certain routine, otherwise time-consuming processes (such as calculating a comprehensive water quality index). The printed computer output provides a yearly report of the status of the simulated region and of interactions within the region during the previous year. There are several types of output: Maps showing characteristics of the region which differ geographically; summaries which present information in capsule form; and detailed information from which the summaries are derived. (See also W72-10307) (Bell-Cornell)
W72-10574

ADMINISTRATION, SYSTEMS ANALYSIS.
Cornell Univ., Ithaca, N.Y. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 05G.
W72-10779

GENERALIZATION OF WHITE'S METHOD OF SUCCESSIVE APPROXIMATIONS TO PERIODIC MARKOVIAN DECISION PROCESSES,
Sun Oil Co., Dallas, Tex.
S. Y. Su, and R. A. Deininger.
Operations Research, Operations Research Society of America, Vol. 20, No. 2, p 318-326, March-April, 1972. 1 fig, 13 ref.

Descriptors: *Markov processes, *Algorithms, *Decision making, *Model studies, Operations research, Optimization, Great Lakes.

The difficulty of using Howard's policy-iteration method to solve a Markovian decision problem with a large number of states is that one has to solve a large system of simultaneous linear equations. Procedures which avoid this difficulty have been developed and have been widely used to handle large scale Markovian decision problems. These algorithms are extended to the case where the Markovian decision process is periodic. Considered is a finite, discrete-time Markovian decision process where both the transition matrix and the return resulting from each transition are periodic with the same cycle. The objective is to find a policy that maximizes the expected gain per cycle in the undiscounted case, or the total expected reward over an infinite time horizon if the future returns are discounted. Proofs of the convergence of these new algorithms are sketched. Some computational experiences based on the modeling of the Great Lakes regulations systems are also given. The problem of lake regulation was formulated as a periodic Markov decision model with a period of 12 months. Results revealed that under any assumption the new policies could reduce the monetary loss by between 15 and 18 percent. (Bell-Cornell)
W72-10780

ANALYSIS OF WATER REUSE ALTERNATIVES IN AN INTEGRATED URBAN AND AGRICULTURAL AREA,
Water Research Lab. Utah State Univ., Logan.

WATER RESOURCES PLANNING—Field 06

Evaluation Process—Group 6B

For primary bibliographic entry see Field 05D.
W72-10781

ECONOMIC OPTIMIZATION OF A SINGLE-CELL AQUIFER,
Washington Univ., Seattle. Dept. of Economics.
For primary bibliographic entry see Field 04B.
W72-10783

NORTH ATLANTIC REGIONAL SUPPLY MODEL,
Meta Systems, Inc., Cambridge, Mass.
R. J. Delucia, and P. Rogers.

Water Resources Research, Vol. 8, No. 3, p 760-765, June, 1972. 2 fig, 2 ref.

Descriptors: *Model studies, *Water resources, *Water supply, *Water requirements, *Cost analysis, *Alternative planning, Regional analysis, Water demand, Water users, Economics, Estimating, Evaluation, Constraints, Freshwater, Waste water (Pollution), Groundwater, Headwaters, Storage, Desalination, Optimization, Systems analysis, Mathematical models.
Identifiers: Linear functions, Nonlinear functions, Cost curves, Simplifying assumptions, Water withdrawal, Mainstream storage.

The NAR study supply model is a mathematical programming model minimizing efficiency costs expressed in annual terms. Presented is a detailed discussion of this model. It is a mathematical programming problem with a nonlinear objective function and all linear constraints. Designed to complement the NAR demand model, the supply model incorporates the cost curves for supply from the headwater and mainstream storage, groundwater, and desalting for 50 subbasins of the NAR planning area and for selected interbasin transfer possibilities. Those cost curves that are nonlinear are approximated by using piecewise linear functions. It is a static annual model based on a critical period analysis and selected risk levels. Hydrologic and instream use constraints are incorporated, and the costs are minimized subject to meeting these and the set of demand constraints. The objective is to minimize the total annual costs of meeting the constraints. Costs are the sum of import, transportation, storage development, and desalination. Presented are simplifying assumptions made to limit the size and complexity of the model. (See also W72-10887 and W72-10888) (Bell-Cornell)
W72-10886

MODEL FOR ESTIMATING REGIONAL WATER NEEDS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
J. C. Schaeke, Jr. and D. C. Major.

Water Resources Research, Vol. 8, No. 3, p 755-759, June, 1972. 1 fig, 6 ref.

Descriptors: *Water demand, *Water requirements, *Estimating, *Regional analysis, Costs, Water resources, Water users, Water quality, Simulation analysis, Computer programs, Mathematical models, Systems analysis, Data storage and retrieval, Alternative planning, Constraints.
Identifiers: Water flow requirements, Water withdrawal.

A model for estimating water flow demands by geographic area, economic sector, and water quality type is described. The model has been constructed for the North Atlantic regional (NAR) water resources study to aid planners in estimating the future requirements of flow in the 50 subbasins of the North Atlantic regional area. The estimates are produced by rules that operate on the basic input assumptions regarding the future regional product, the per capita income, the population, the distribution of economic activity, the use of water, and technology. The collection of rules includes an economic input-output model, a regression estimator for publicly supplied municipal and industrial water use, and a variety of arithmetic operations.

These rules are imbedded in an information system that accepts input information in a problem-oriented format and provides output information as selected by the user in an annotated form suitable for use in final reports. The information system provides options for editing data, storing and retrieving data sets, and comparing input and output information for any two runs. The model can easily be adapted for use in other water resource planning operations, and can be used to estimate pollution loadings as well as flow demand. (See also W72-10886) (Bell-Cornell)
W72-10887

THE NAR STUDY: A CASE STUDY IN SYSTEMS ANALYSIS,
Corps of Engineers, New York. North Atlantic Div.

H. E. Schwarz.
Water Resources Research, Vol. 8, No. 3, p 751-754, June, 1972. 2 ref.

Descriptors: Water resources, *Alternative planning, *Regional analysis, *Water supply, *Water users, Management, *Model studies, Economics, Estimating, Costs, Water quality, Computers, Optimization, Simulation analysis, Constraints, *Systems analysis.
Identifiers: Water withdrawal, Simplifying assumptions.

Characteristics of the North Atlantic regional (NAR) water resources study, its objectives and modeling techniques are described. The study extends to the year 2020 and seeks optimum development of water and related land resources. Two models, a demand model and a supply model for water withdrawal uses, appeared to be practical within the limits of data and time. Specifications for the demand model included consistent economic parameters, the separation of procedures for the economic and technologic assumptions, the separation of demands into broad water quality groups, the ability to aggregate data, the simplification of input data modification, the production of self-explanatory outputs, and complete control by the user of all the input and output functions. The specifications for the supply model included compatibility with the demand model, use of generalized cost curves for six supply categories, use of hydrologic and instream use constraints, and optimization by cost minimization. Water resource planning should be objective oriented, must strive to search out as many alternatives as practicable, must be flexible to respond to changes in conditions, objectives, and values, and should be a continuous process rather than culminating in a single final plan. (See also W72-10886) (Bell-Cornell)
W72-10888

IRRIGATION PLANNING 4. OPTIMAL INTER-SEASONAL WATER ALLOCATION,
Montana State Univ., Bozeman. Dept. of Economics; and Montana State Univ., Bozeman. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W72-10890

BEST COMBINATION OF WASTE TREATMENT AND SPATIALLY DISTRIBUTED DISCHARGE OF EFFLUENT,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Chemical Engineering; and Rutgers - The State Univ., New Brunswick, N.J. Dept. of Biochemical Engineering.
For primary bibliographic entry see Field 05D.
W72-10891

A GENERALIZED MODEL OF A RESOURCE-POPULATION SYSTEM: I. GENERAL PROPERTIES,
Cornell Univ., Ithaca, N.Y. Div. of Biological Sciences.
G. C. Gallopin.

Oecologia (Berl), Vol 7, No 4, p 382-413, 1971, Illus.

Identifiers: Computers, Food, *Mathematical models, *Model studies, Population, Resources, *Resource allocation.

A basic structure for mathematical models of resource-population systems is presented. This basic structure may be specified in order to include different alternative hypotheses and it represents, therefore, a family of particular models. The study of one of its particular realizations shows that its behavior agrees qualitatively with what should be expected from biological considerations. Even when the system of nonlinear differential equations could not be solved explicitly, important information has been obtained by studying its properties in the limiting cases, its sensitivity to changes in the parameters, and the results of computer simulation. The proposed model, duplicating some of the basic features of a population living under resource limitation and allowing a coupling with a predator population, is intended to be used as an elementary component in food web or ecosystem theoretical studies. The studies need not include detailed descriptions of the population variables, but rather only its essential, gross features, in order to explore the properties that characterize the complete systems. (See also W72-10940) Copyright 1972, Biological Abstracts, Inc.
W72-10939

A GENERALIZED MODEL OF A RESOURCE-POPULATION SYSTEM: II. STABILITY ANALYSIS,
Cornell Univ., Ithaca, N.Y. Div. of Biological Sciences.
G. C. Gallopin.
Oecologia (Berl), Vol 7, No 4, p 414-432, 1971, Illus.
Identifiers: *Mathematical models, *Model studies, Population, Resources, Stability, *Resource allocation.

A system of nonlinear differential equations describing a resource-population system is analyzed in terms of the existence and characteristics of its equilibrium states. It is proved that, under the condition that $K < \alpha \beta$ (necessary condition for the population being able to grow under optimal conditions), it is a necessary and sufficient condition for the system to have a steady state that the resource input rate to the system be constant. When the resource input rate is a constant different from zero, the system has only 1 equilibrium point, at $MO = \beta \alpha f_0/k$, $AO = -(f_0 \alpha/k) \ln(1 - k/\alpha \beta)$, and this equilibrium point is always stable. In other words, the system population-resource will always reach the steady state, either monotonically (node) or by damped oscillations (focus), from an arbitrary initial condition in the positive quadrant. When the resource input rate is equal to zero, the system has an infinite number of equilibrium points at $MO = 0$, $AO = \text{constant}$. All these equilibrium points are unstable in the sense that a slight increase in M will move the system away from the equilibrium states, except for the point $MO = 0$, $AO = 0$, which is the only stable equilibrium point, to which the system will tend. This stable equilibrium point corresponds to the condition of complete annihilation of both resource and population. Finally, it is proved that the system does not have limit cycles in the positive quadrant and is therefore incapable of self-oscillations. (See also W72-10939) Copyright 1972, Biological Abstracts, Inc.
W72-10940

6B. Evaluation Process

SOCIAL AND ECONOMIC ASPECTS OF WATER RESOURCES DEVELOPMENT.

Proceedings of Symposium held at Cornell University, Ithaca, New York, June 21-23, 1971.

Field 06—WATER RESOURCES PLANNING

Group 6B—Evaluation Process

The American Water Resources Association, Urbana, Illinois, 1972. L. B. Dworsky, D. J. Allee and S. C. Csallany, editors. 245 p.

Descriptors: *Water resources development, *Planning, Political aspects, Decision making, Social aspects, Education, Resources development, Environment, *Water policy.

A symposium on social and economic aspects of water resources development was sponsored by The American Water Resources Association in cooperation with Water Resources and Marine Sciences Center, Cornell University, Ithaca, New York. Public participation in the planning process and the nature of public education related to planning were explored. Human ecology and the ecology of other biological communities also were discussed. Integrated planning and development approaches to water and related land resources planning and environmental matters was the third major subject. (See also W72-10481 thru W72-10510)
W72-10480

DIFFUSION OF TECHNOLOGY AND POLITICAL INFORMATION: WHAT THEORY DO WE HAVE,

Department of Agriculture Washington, D.C. Cooperative State Research Service.

K. P. Wilkinson.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois, 1972, p 2-6. 18 ref.

Descriptors: *Water resources development, *Technology, *Political aspects, Planning, Benefits.

Identifiers: *Social science theory, Interdisciplinarity, Policy making.

The problem of the overlap between technology and political information in water resources considerations is discussed. A brief review of the advantages and disadvantages of articulating a normative social science strategy for water resources action is presented. A synthesis of the relevant theoretical materials from the various levels of analysis and a careful application of this synthesis to specific water resources problems are called for. The conceptual framework of technology transfer theory and normative technological forecasting could provide the background for such a synthesis. Much social science theory relevant to the water resources field is not yet at the level of technology and may never be. Despite the openness of social science theory, some of its propositions and perspectives are highly predictive and useful. The general movement in social science toward a configurational, multi-leveled, multi-dimensional approach to reality, is at present a trend common to all of science. Horizontal technology transfer is a development of the same movement. A convergence is probable between technology and political information which could be of great benefit to water resources development. (See also W72-10480) (Strachan-Chicago)
W72-10481

UNIVERSITY PUBLIC SERVICE PROGRAMS AS THEY RELATE TO WATER RESOURCES MANAGEMENT IN WISCONSIN, Wisconsin Univ., Madison.

S. M. Born, M. T. Beatty, and D. A. Yanggen.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y. June 21-23, 1971. The American Water Resources Association, Urbana, Illinois, 1972. p 27-36. 15 ref.

Descriptors: *Water resources development, *Management, *Universities, *Wisconsin, Planning, Decision making, Cooperation, Administration.

Identifiers: *Public service programs, *University of Wisconsin, Policy making, University participation.

The university's role in public affairs is an integration of the university's teaching, research, and extension activities to fulfill a public service role. Universities can contribute to the solution of pressing societal problems. One dimension of the university's role, in the area of water resources management, as it applies to the University of Wisconsin is described. Attention is focused on two contemporary activities of the University: involvement with Wisconsin's Shoreland Protection Program, and involvement with the Inland Lake Demonstration Project. The changing role of the University of Wisconsin with regard to water resource management issues has had significance throughout the state. (1) University people have helped to shape and define the mission of restructured state agencies. (2) University programs (educational and otherwise) have helped lead to a general acceptance of planned comprehensive approaches to solving natural resource problems. (3) Policy makers have become aware of the important role that the University can play in the education of constituencies regarding new programs. (4) Legislative and administrative programs fostered by the University and University-influenced agencies have led to an increase of environmentally-oriented programs by local government. (See also W72-10480) (Strachan-Chicago)
W72-10483

THE SUSQUEHANNA PUBLIC INFORMATION AND PARTICIPATION EXPERIMENT, Army Engineer District, Baltimore, Md.

K. H. Murdock.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois, 1972. p 42-45. 1 fig.

Descriptors: *Information exchange, *Planning, *Decision making, Cooperation, Communication, Water resources development, Management, Administration.

Identifiers: *Public participation, *Susquehanna Study, *Policy making, Compromise.

The Susquehanna Study encouraged citizen participation and marshalled the forces within the Federal government itself to be responsible for greater citizen participation. The two major objectives of the Susquehanna approach were: (1) to formulate alternatives and present them to the public for consideration, and (2) to take into consideration and/or incorporate the recommendations of the citizens. Public participation and interest were maintained through the publication of a bi-monthly newsletter, workshop meetings, and public forums. The results of the concern for public opinion included: improved communication between the public and the planning staff, locally significant adjustments before completion of the report, increased confidence in the program on the part of the public, and effective compromise. The research team made the following conclusions. (1) There is a need for a public involvement communication program in comprehensive water resources planning efforts. (2) Additional staff arrangements and training programs are needed if these programs are to be conducted effectively. (3) The planning agency must develop a local contact network centered around local water experts' and community opinion leaders, which would provide information exchanges between the affected agency and the local publics. (4) Sufficient resources must be committed to the program to provide the means to carry it out on a well-defined, coordinated, and continuing basis. (See also W72-10480) (Strachan-Chicago)
W72-10484

PARTICIPATION IN WATER RESOURCE PLANNING,
 Battelle Memorial Inst., Columbus, Ohio.

J. R. Finley.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois, 1972. p 46-53. 2 tab, 16 ref.

Descriptors: *Planning, *Decision making, *Water resources development, Model studies, Administration, Personnel management, Costs, Social aspects.

Identifiers: *Public participation, *Eastern Susquehanna River Basin, Conflict, Conceptual model.

How greater understanding of complex social situations such as conflict in water resource decision making, aids in the formulation of solutions to such social problems is illustrated. Results are presented of a case study of citizen participation in water resources decision making in the Eastern Susquehanna River Basin. The field work of this year-long study consisted of extensive contacts and intensive interviews with local citizenry and planning officials. Water resource planning in this particular area exhibits classic patterns of conflict with contesting parties subordinating internal cleavages for the common good of defeating the intention of the opposing group. The results of this investigation will provide resource planners with a conceptual model for involving lay persons in the planning activity. Traditional or conventional approaches to planning and development are inadequate for the changing times. Changes must be made in the orientation and structure of planning and development agencies. Among the structural changes suggested are: (1) the removal of the planning function from the administrative function, (2) the employment of personnel who have both technical and human relations training and capabilities, and (3) the initiation of studies of probable social costs associated with various alternatives in addition to economic and environmental impact studies. The responsibility of the planner is to arrive at that alternative which impacts the social fabric at a minimum. (See also W72-10480) (Strachan-Chicago)
W72-10485

CASE STUDY: PUBLIC INVOLVEMENT IN PLANNING U.S. ARMY CORPS OF ENGINEERS, Army Engineer District, Seattle, Wash.

R. P. Sellevold.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois, 1972. p 56-60. 6 fig.

Descriptors: *Planning, *Decision making, *Information exchange, Model studies, Cooperation.

Identifiers: *Public participation, *U. S. Army Corps of Engineers, Interaction.

The Seattle District is committed to an objective of 'fish bowl planning', in which a maximum of information is made available to the public throughout the study process. Techniques of public meetings, workshops, news releases, invitational meetings, letters and the telephone are used in an effort to get the public, interested agencies, and groups involved from the beginning to the end of the planning process. A public brochure serves to combine all these efforts, offers continuity, and records the result. The major benefit of 'fish bowl planning' has been to the planner. Problems and issues have been isolated early which has been a tremendous asset in scoping further study efforts, avoiding unnecessary work, and precluding study of an alternative that was simply publicly unacceptable. This model for public participation is now underway on about ten studies. (See also W72-10480) (Strachan-Chicago)
W72-8486

CAN CITIZENS INVENT THEIR FUTURE. --
CASE STUDY OBSERVATIONS OF PUBLIC

WATER RESOURCES PLANNING—Field 06

Evaluation Process—Group 6B

PARTICIPATION IN ENVIRONMENTAL MANAGEMENT,

Michigan Univ., Ann Arbor.

S. W. Havlick.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois. 1972. p 61-65. 5 ref, append.

Descriptors: *Environment, *Management, *Planning, *Decision making, Organizations, Institutions, Ecology, Consumptive use.

Identifiers: *Public participation, *Policy making, Coalitions, Alliances, Washtenaw Environmental Council.

Organizations, coalitions, and other alliances of environmental advocates appear to be increasingly effective agents of change. The impact of these recently spawned environmental agencies upon traditional resource-related governmental agencies or private corporations cannot be adequately measured after such a short period of institutional experimentation. Their slogans and labels, i.e., ecosystem, ecology, etc., have been quickly picked up and exploited. However, it is doubtful that serious substantive changes in the direction of comprehensive environmental management will be invented or implemented by those who are on a "middle-class environmental kick." Change will come when the present patterns of consumptive and unecological living, particularly by the middle class, are identified as the actual villains corrupting the American environment. These localized organizations do serve as useful testing and proving grounds for skills and methodologies which may be required in larger struggles, if current efforts are thwarted. Enact, Western Michigan Environmental Council on Environmental Action, and the Washtenaw Environmental Council are three coalition-type-organizations which are considered in terms of their formation and organization. The By-Laws of the Washtenaw Environmental Council are reproduced in the appendix. (See also W72-10480) (Strachan-Chicago)

W72-10487

CASE STUDY: STIMULATING COMMUNITY INVOLVEMENT: BRINGING TO PUBLIC DECISION MAKERS THE POINT OF VIEW OF PRIVATE CITIZENS,

Water Resources Association of the Delaware River Basin, Philadelphia, Pa.

P. M. Felton.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois. 1972. p 69-70.

Descriptors: *Decision making, *Planning, *Environment, *Water resources development, Quality control, Conservation, Information exchange, Education.

Identifiers: *Water Resources Association of the Delaware River Basin (WRA), *Public participation, Policy making.

The Water Resources Association of the Delaware River Basin (WRA) is a non-profit, information/education agency. It gathers facts, monitors programs and agencies, and provides its members and the general public with the forums and factual material upon which each person or member group can make decisions to support the programs of his choice in the manner he chooses. Staff talks, monthly newsletters, bulletins, information leaflets, annual reports, films, exhibits, factual brochures, hearings, seminars, regular Spring and Fall conferences, committee meetings, field trips, and news releases are tools used by the WRA to stimulate citizen involvement with environmental problems. It is becoming increasingly more difficult to gain support for projects planned by the U.S. Corps, Delaware River Basin, and other local groups due to the rising tide of objections, including the voice of the WRA. Certain changes could

be made which would make water resources planning more responsive to public needs. (1) More lenient I.R.S. regulations which would allow responsible and well-informed tax-exempt conservation organizations to speak more freely before legislative committees in hearings. (2) Establishment of more advisory councils, task forces and committees where representatives of communities and citizen organizations would have a quasi-official voice in the planning process. (3) More complete disclosure of planning objectives. (4) More opportunity for the public to speak up in public hearings, reviews and meetings. (See also W72-10480) (Strachan-Chicago)

W72-10488

DEVELOPMENT OF A MODEL EDUCATIONAL PROGRAM TO IMPROVE ENVIRONMENTAL DECISION MAKING IN A LAKE WATERSHED - CANADARAGO LAKE, NEW YORK,

S. K. Wright.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois. 1972, p 71-75.

Descriptors: *Education, *Model studies, *Decision making, *Planning, *Environment, Quality control, Water resources development, Communication, Information exchange, Coordination, Motivation.

Identifiers: *Canadarago Lake watershed, Public participation, Community action.

An educational program dealing with environmental quality problems develops a clearer understanding of the inter-relations of the factors contributing to environmental problems and can lead to establishment of goals for action, motivation, and mobilization of resources to take action based on clearly defined alternatives. The basic philosophy of the model educational program discussed is that a process of communication can be developed which will enable citizens and leaders in a lake watershed to make informed decisions based on a clear understanding of alternatives. The three stages of the educational model proposed for the watershed of Canadarago Lake are: (1) audience identification and fact finding - knowledge of problems of water resources will be supplied by extension of the information base, (2) coordination of communication - increased communication between professionals, citizens, and leaders, and (3) motivation for community action - as a result of the improved communication, action will be taken to improve water and environmental quality of the lake and its watershed. Decisions will be made in the next couple of years on environmental quality and water quality problems in the Canadarago Lake Watershed which will have state wide and national implications. This educational model provides an opportunity of testing the role of education in improving the quality of these decisions. (See also W72-10480) (Strachan-Chicago)

W72-10489

SOCIOLOGICAL CONCEPTS: A CRITIQUE OF WATER RESOURCES PLANNING,

Pennsylvania State Univ., University Park, Pa.

S. M. Leadley.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois. 1972. p 77-78.

Descriptors: *Water resources development, *Planning, *Decision making, *Social aspects, Costs, Communication, Economics, Organizations.

Identifiers: *Goal formation, *Public participation, *Goal hierarchies, *Organizational vulnerability, Policy making.

Relationships between water resources planning and: (1) goal formation, (2) public participation, (3) goal hierarchies, and (4) organizational vulnerability are discussed. The processes by which varied ends become articulated and weighed against each other are only partially known and understood. The process of goal formation can be viewed as planning within the constraints of sets of goal hierarchies. Some of the implications of this approach to goal formation are: (1) the validity of the absolute commitment to solving a water resource problem simply because it exists regardless of the associated social and economic costs is questioned, (2) the inevitable differences between different levels of social organization in perceived urgency of attaining a goal are taken into account, and (3) sufficient resources can be allocated to planning as a social process in order to reduce the gaps in communication among levels of government. Doubts about the efficacy of the present planning process result from a lack of public participation. However difficult the problems of gaining public participation, the water resource management decisions must be supported by the public in terms of either dollars or abuse avoidance. By preparing imaginative and thorough environmental impact statements and by assisting in the formulation of innovative plans for environmentally sound but not agency-focused water management structures and practices, the inhouse specialist is increasing his agency's vulnerability to budget cuts and an unfavorable press. When planning is examined as a social process, it is found to be sensitive to other social forces, i.e., individual and organization goals, and public participation. (See also W72-10480) (Strachan-Chicago)

W72-10490

SOLID WASTE MANAGEMENT IN CENTRAL NEW YORK, A REVIEW OF PLANNING AND COMMUNITY EDUCATION,

Cooperative Extension Mid-New York Project, Syracuse, N.Y.

M. G. Anderson.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois. 1972. p 80-85. 4 ref.

Descriptors: *Planning, *Education, *Solid wastes, *Management, Communication, Decision making, Regional development, Comprehensive planning, City planning, Economics, Administration, Social aspects, Values.

Identifiers: *Central New York, *Cooperative Extension Mid-New York Project (MIDNY), Comprehensive regional planning, Public participation, Relevant planning, Service programs, Conflict utilization.

Conclusions drawn over several years from the MIDNY Project focus on activities by Cooperative Extension in the area of solid waste management in the five-county Central New York comprehensive planning region. The MIDNY Project staff has developed a community educational role, working closely with planning efforts at all levels. Educational efforts are structured to bring about awareness of regions, improve communication among leaders, help agencies better identify their role in relation to others, and promote organization which will enhance decision making at the regional level. The following conclusions were drawn. (1) Agency and organizational roles must be understood, redefined, and articulated as the move is made towards regionalism. (2) Community education frequently has a rural orientation, while comprehensive regional planning is an outgrowth of urban planning. There must be recognition of these different roles and their areas of overlap in regional development. (3) The meshing of community education and comprehensive planning is necessary. (4) There must be additional financial input into community education, or plans will continue to go unheeded. (5) Improved communication among administrators is needed at the regional

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level. (6) Effective regional development may require a combination of increased citizen participation, relevant plans, effective community education, flexible service programs, governmental sensitivity to changing social needs and values, and effective mechanisms for utilizing conflict and dissent. (See also W72-10480) (Strachan-Chicago) W72-10491

POWER PLANT SITING ON LAKE MICHIGAN, Argonne National Lab., Ill.

L. E. Link.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois. 1972. p 88-90.

Descriptors: *Lake Michigan, *Thermal power, *Industrial plants, *Sites, Conservation, Recreation, Industrial production, Water resources development, Management, Education, Long-term planning, Benefits, Alternative planning.
Identifiers: *Compromise, Public participation.

Opinions relating to siting of electrical generating plants on Lake Michigan are summarized. The major conflict with using shore property for any industrial use is the public desire to maintain lake frontage for recreational use. The specific problem with respect to power plants using once-through cooling is the concern about the lake's ecosystem due to the large quantities of warm water discharged into the lake. Removing Lake Michigan as a focus of power plant siting may well be a temporary situation. State or preferably regional authorities should be established with the responsibility to work out optimal land and water uses within the broad framework of demands on these resources. There is a need for more public education. It is relatively easy for an intervening group to find a valid basis for their objections in almost all power plant siting cases. At the same time, it is equally easy for a utility to find evidence to refute or counterbalance the interventionists' argument. There are no free solutions and a forum is needed with which to arrive at the compromise which has the maximum long-term benefit. All branches of the communication media must impress the public that they must participate in this procedure to determine the least obnoxious of alternatives. The Lake Michigan situation is typical. The impasse can be downgraded by more sensible forum approaches where all parties of the controversy arbitrate their differences by mechanisms of understanding. (See also W72-10480) (Strachan-Chicago) W72-10492

AN INNOVATIVE EDUCATIONAL EFFORT TO EXPLORE WAYS OF IMPROVING LOCAL DECISIONS AFFECTING ENVIRONMENTAL QUALITY,

Cornell Univ., Ithaca, N.Y.

L. S. Raymond, Jr.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois. 1972. p 91-94.

Descriptors: *Education, *Decision making, *Planning, *Environment, *Quality control, Regional planning, Communication.
Identifiers: *Shackleton Point research group.

The origin and development of a group composed of representatives from regional planning agencies, technical agencies, and educational institutions in central New York State are discussed. This group first met in October, 1970 at Cornell University's Shackleton Point research station to discuss suggested environmental education activities in the Central New York region. Some tentative conclusions are drawn. (1) Encouraging activities to increase awareness and understanding of a situation is helpful, but is clearly too academic to

be useful to the decision makers themselves. (2) Although missions, goals, and objectives must be stated for such groups as the Shackleton research group, the most important accomplishment is not the fulfillment of these ends. Rather the fact that regional agencies and groups began working together on an issue and established common grounds for communication is more significant. (3) The success of such attempts depends upon someone doing a lot of informal background work, acting as a communicator to keep the flow of ideas and suggestions moving from one agency or group to another. (4) Although a large part of these efforts is exerted voluntarily or as part of the duties of a regular agency, commitment of funds to be used specifically for such purposes is probably necessary. (See also W72-10480) (Strachan-Chicago) W72-10493

THE ROLE OF EXTENSION IN RESOURCE MANAGEMENT: A DISCUSSION,

Cornell Univ., Ithaca, N.Y.

L. Shabman.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois. 1972. p 95-96.

Descriptors: *Resources development, *Planning, *Decision making, *Management, *Training, Environment, Quality control, Information exchange, Regional planning, Education.
Identifiers: *Extension, Public participation, Community education, Knowledge, Awareness.

The role of extension in resource management is discussed. Four roles for extension are: (1) as a source of information, (2) as a collector and cataloger of information, (3) as a conduit for information from researchers to users, and (4) as a forum for debate and to facilitate the bargaining process fundamental to public decision making. Extension is needed in all of these roles. (1) Public officials must increase their awareness of environmental matters and their knowledge of environmentally important areas in the region, and the public should call upon them to demonstrate this knowledge. (2) A mechanism should be developed through which interaction between public officials and environmental groups can be increased. (3) Planning agencies should jointly compile an Environmental Inventory, listing areas of environmental importance in the region. (4) There must be increased efforts to disseminate existing environmentally important information to the community at large, i.e., community education. (See also W72-10480) (Strachan-Chicago) W72-10494

CASE STUDY ON COW GREEN CONTROVERSY,

Corps of Engineers, New York. North Atlantic Div.

J. E. Frost.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois. 1972. p 97-100. 1 fig.

Descriptors: *Planning, *Decision making, *Water resources development, Communication, Model studies, Information exchange, Social aspects, Values, Governments.

Identifiers: *Cow Green controversy, Public participation, Information interpretation.

Cow Green controversy resulted from a proposal to locate an impounding reservoir in a valley known as Cow Green on the Tees River in northern England. The following observations were made: (1) Economic and development considerations dominated considerations of preserving flora and fauna. (2) Locally affected interests did not oppose the Cow Green proposal, thereby

obliging the botany and conservation interests to seek wider and more general, but less powerful support. (3) The one comprehensive and objective analysis of the pros and cons of the proposal was not considered at the Parliamentary level because of the County's decision not to oppose the proposal. (4) Agricultural interests teamed with promoters in arguing that there was indeed no feasible alternative to Cow Green. (5) The Cow Green experience suggests that the impetus for water resources development policy is local. A public communication model is proposed with the following elements: (1) analysis of the communication situation, (2) alternative means for communication in that situation, (3) types of information to be communicated, (4) involved publics whose values should be considered, (5) interpretation of the information, (6) insertion of the information into the program's decision processes, and (7) evaluation of the public communication activities throughout the program. Relationships between public values, bureaucrats and program decisions are central to good decision making in government programs. (See also W72-10480) (Strachan-Chicago) W72-10495

THE COMMISSION FORM OF POLICY DETERMINATION: IS THE PUBLIC INVOLVED?

Cornell Univ., Ithaca, N.Y.

G. D. Davis.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois. 1972. p 102-104.

Descriptors: *Planning, *Decision making, *Institutional constraints, Administration, Political aspects, Information exchange.

Identifiers: *Commissions, *Policy making, *Public participation, Adirondack Study Commission, Temporary Study Commission on the Future of the Adirondacks.

A brief history of the Adirondack Study Commission and the Temporary Study Commission on the Future of the Adirondacks is presented. A commission is selected to recommend policy, and it must recommend what it sees fit. Reflecting public opinion is a function of the political sector but commissions must go beyond the academic. They have an obligation to involve and inform the public. Appointing a commission has several advantages to the administrator: delaying decision making, avoiding issues, gauging public opinion, and redirecting blame. However, a commission can act to remove some of the innate suspicion and fear the public has of government bureaucracy. (See also W72-10480) (Strachan-Chicago) W72-10496

DESIGNING AN ENVIRONMENTAL STUDY TO MEET THE NEEDS OF PLAN FORMULATION AND EVALUATION,

Rutgers - The State Univ., New Brunswick, N.J.

W. Whipple, Jr.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois. 1972. p 106-109. 8 ref.

Descriptors: *Planning, *Evaluation, *Formulation, *Environment, Communication, Social aspects, Engineering, Ecology.

Identifiers: *Environmental impact studies, Public participation, Cooperation.

Frequently in proposed solutions to environmental problems two urgent social imperatives come into irreconcilable conflict: the preservation of a state of nature, and the provision of outdoor recreation for growing urban areas. Three major problems in establishing a planning procedure more appropriate to the solution of environmental

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problems are identified. (1) The gap between developmental engineers and their ecological critics has become too wide. (2) Biological study and research is not one, but a number of disciplines. (3) Biologists usually choose to study their chosen species in its natural habitat. (4) Most of the time, data are not available to establish the nature of the present ecological situation or to predict the effect of physical changes. The new planning procedures which provide for environmental impact studies to broaden the basis of planning are sound in principle. Many suggestions have been made for increased public participation in the planning process, but such changes take time and absorb energy. Some changes of attitude must be brought about. Biologists should realize that it is mandatory that they study altered environments. Engineers, architects, and planners should realize that they must work with biologists. There must be an intellectual synthesis of approach, based upon established working relationships. (See also W72-10480) (Strachan-Chicago) W72-10497

ECOLOGY I AND II, RESOURCE ECONOMICS AND WATER RESOURCE DEVELOPMENT, D. Chapman.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois. 1972. p 110-116. 5 tab, 1 fig, 9 ref.

Descriptors: *Ecology, *Resources development, *Economics, *Water resources development, Environment, Systems analysis, Water supply, Management, Performance, Measurement, Costs, Value.

Identifiers: *Resource economics, Interdisciplinary study, Functionalism, Hetch-Hetchy Valley (Calif), System performance.

The relationship between resource economics and water resource development is examined. Three methodological aspects of interdisciplinary study are relevant to this subject. (1) The scientific understanding of the majority of environmental problems involves both ecology and resource economics. (2) Interdisciplinary study often falls to the level of the lowest common denominator of the involved disciplines. (3) The tension between positivism and normativeness is common to both fields. An important consideration is a view of the degree of joint sharing of the concepts of systems analysis and functionalism in ecology and resource economics. Three aspects of water supply as a functional system are components, a performance measure, and management. The Hetch-Hetchy Valley of California is examined to determine if the performance measure of social cost and social value indicates proper management. The perceived value of particular forms of ecosystems—their nonmonetary value—is of primary importance to environmental problems. The correct estimation of social cost and social value as measures of system performance and component management is impossible without responding to this need. It seems apparent that systems analysis and environmental quality will have some unexpected results for both ecology and resource economics in the water supply field. (See also W72-10480) (Strachan-Chicago) W72-10498

ENVIRONMENTAL, ECONOMIC AND SOCIAL ASPECTS OF THE CROSS FLORIDA BARGE CANAL, Army Engineer District, Jacksonville, Fla. A. Fullerton.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois. 1972. p 121-125. 3 tab.

Descriptors: *Environment, *Economic justification, *Social aspects, *Florida, Quality control, Fishing, Eutrophication, Aquatic weed control, Transportation, Recreation, Regional planning, Land use.

Identifiers: *Cross Florida Barge Canal.

The Cross Florida Barge Canal was authorized in 1942. Construction was halted in 1971. The project provides for a barge canal 107 miles long, extending from the St. Johns River near Palatka, Florida through the Oklawaha and Withlacoochee Rivers to the Gulf of Mexico. The environmental aspects, the economic aspects, and social aspects of the project are discussed. Although the construction of the canal has undoubtedly affected the plants and animals of the area, such environmental change is not necessarily all bad. Construction of Lake Oklawaha has greatly increased fishing opportunities and harvest. The major environmental problems associated with Lake Oklawaha are expected to be eutrophication and aquatic weeds. The Army Corps of Engineers feels that the project is economically justifiable. The benefits which would result from the construction are: transportation savings on movements of bulk commodities, general recreation benefits, commercial fishing boats, contractor floating plant, new vessel deliveries, transient recreational boats, flood control, land enhancement, industrial development, and new employment opportunities. Transportation savings and recreation benefits resulting from the canal would ultimately be passed along to the consumer. Regional long-range land-use planning will be needed along the entire length of the canal. (See also W72-10480) (Strachan-Chicago) W72-10499

TOWARD A THEORY OF COMPROMISE IN ENVIRONMENTAL DISPUTES, Connecticut Univ., Storrs.

C. D. Stern.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois. 1972. p 126-131. 10 ref.

Descriptors: *Environment, *Judicial decisions, *Planning, *Decision making, Flexibility, Information exchange, Alternative planning, Coordination, Legal aspects, Conservation.

Identifiers: *Compromise, Objectives, National Environmental Policy Act, Policy making.

Short case studies of environmental conflicts in Echo Park, Colorado, the Central Arizona project, the Missouri Breaks, Storm King Mountain, the Florida Barge Canal, Sunfish Pond, New Jersey, and Tocks Island are presented. Some of these cases were amenable to compromise, while others were not. While litigation has been helpful to the environmental cause on specific issues, it would be a mistake to rely on the courts as a substitute for the process of compromise. In order to exploit the opportunities for compromise when they present themselves, it is essential for the parties to have room to maneuver. Compromise is more readily attainable where some set of objectives has been defined, preferably by the decision maker. Flexibility decreases as commitments are made either to a public position or to actual physical investments. The National Environmental Policy Act has taken the arbitrariness out of information disclosure patterns. This has improved the decision making process by alerting the developer to factors that before went unexamined, and by giving individuals access to factual material from which they can suggest alternative solutions to the initial formulation of the proposal. Eventually, this improved decision making process will result in more ammunition for court action and a forum for compromise. (See also W72-10480) (Strachan-Chicago) W72-10500

JAMAICA BAY/KENNEDY AIRPORT ANATOMY OF A TECHNOLOGICAL ASSESSMENT, National Academy of Sciences, Wash., D.C. S. Ebbin.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois. 1972. p 134-146. 1 ref.

Descriptors: *Assessments, *Planning, *Decision making, Environment, Quality control, Conservation, Technology, Pollution abatement, Costs, Benefits, Value.

Identifiers: *Jamaica Bay/Kennedy Airport Study.

The Jamaica Bay/Kennedy Airport study (National Academy of Sciences, National Academy of Engineering) carried out a prototype multi-disciplinary effort. Despite the institutionally-related difficulties, the study proved that such assessments could be done well and effectively. It also illustrated that a new institutional mechanism will be needed if technology assessments are to become a regular part of the public decision making process. The following conclusions were made (1) any runway construction will damage the natural environment of the Bay and reduce its potential use for conservation, recreation, and housing; (2) the Bay environment can be improved by technological means, although airport expansion would increase the economic costs or dilute the benefits of these improvements; (3) construction of new runways will not significantly reduce the number of residents in nearby areas; and (4) permanent conversion of any estuarine area to airport or other commercial or industrial use diminishes a national environmental asset of great potential value to future generations. (See also W72-10480) (Strachan-Chicago) W72-10501

EVALUATION OF RECREATION SUPPLY RELATIONSHIPS FOR OUTDOOR RECREATION DEVELOPMENT, Michigan State Univ., East Lansing.

E. Dersch.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois. 1972. p 156-157. 1 fig.

Descriptors: *Evaluation, *Recreation facilities, *Recreation demand, *Optimization, Planning, Long-term planning, Designing, Decision making, Optimum development plans.

Identifiers: *Recreation supply function, Information collection.

A recreation supply function is developed. An examination of recreation supply relationships inherent to a recreation site is needed before any designs are made on the site's development for satisfying a recreation demand. The recreation supply function concept provides two important kinds of information useful in the decision making process. (1) It provides a usable natural resource assessment that includes an inventory of soil types and characteristics, vegetation and geological features of the land, and an inventory of basic water resources. (2) It provides the decision maker with a more inclusive perspective of the impact that each alternative recreation use might have on the total recreation resources base of an area. A simplified hypothetical case is presented. Linear programming can be adapted as an optimization technique. The recreation supply function provides a tool which the recreation planner may use as a guide in designing and developing a recreation area. It provides much of the information needed to derive an optimal development strategy for a recreation area. It is almost unlimited in its application to the preservation of natural features vital to growing recreation demand. This concept might also be expanded to provide the supply function for larger areas. (See also W72-10480) (Strachan-Chicago) W72-10502

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EXPERIENCE OF THE CORPS OF ENGINEERS IN PREPARING ENVIRONMENTAL IMPACT STATEMENTS, Institute for Water Resources (Army), Alexandria, Va.

D. Aggerholm.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971, The American Water Resources Association, Urbana, Illinois. 1972. p 163-165.

Descriptors: *Planning, *Evaluation, *Environmental effects, Governments, Assessments, Resources, Methodology, Analysis, Information exchange, Data collections, Communication, Research and development.

Identifiers: *Army Corps of Engineers, *Environmental impact statements, Environmental Policy Act, Policy making, Organizing concepts.

The Corps of Engineers' performance in the preparation of environmental impact statements required by the Environmental Policy Act of 1969 is evaluated. Generally, performance has been average with respect to following the letter of the law, but less than desirable in conforming to its spirit and intent. The following factors are considered: commitment, rewards and punishments, resources, money, manpower, time, basic organizing concepts and definitions, tools, information, communication, and organization and management. There is a decided lack of commitment to the spirit of the Act at all levels of government. There are few incentives in the system for taking environmental assessment seriously. Money, manpower, and time are needed and seriously lacking. There is a lack of working organizing concepts and definitions, while a dearth of methodology, procedures and criteria for measurement and analysis exists. The problem of information is very critical. The amount of data needed must be measured. Communication must be improved between those who make policies and those who apply them; between researchers and practitioners; between disciplines; and between the public and the government. The organization of resources has not been given adequate thought. Comparatively little concern has been directed toward structuring a system to continuously improve the substance of statements or to define research needs and priorities. (See also W72-10480) (Strachan-Chicago)

W72-10503

A REGIONAL APPROACH TO IMPROVING THE ENVIRONMENT: THE APPALACHIAN EXPERIENCE, Appalachian Regional Commission, Washington, D.C.

D. A. Crane.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971, The American Water Resources Association, Urbana, Illinois. 1972. p 166-173. 1 fig, 13 ref.

Descriptors: *Regional planning, *Environment, *Decision making, Governments, Flexibility, Coordination, Funding, Institutional constraints, Application methods, Management.

Identifiers: *Appalachian Regional Commission, Initiative, Guidance.

Traditional State or Federal programs were not considered sufficiently responsive to meet the needs of, or address the problems of, the Appalachian Region. Consequently, the Appalachian Regional Commission was established. The Commission represents a balance of power between the Governor of the States, the executive branch of the Federal government, and the Congress. Initiative for projects comes from the member States. Flexibility is required on the part of Federal agencies under their national program guides. Coordination and guidance of State programs are provided. Decision making in the Commission fully reflects these attributes. A program decision needs the affirmative vote of more than one-half of the States and of the Federal Co-Chairman. Program

decision with respect to projects or other applications for funds must originate with the State's (s') Representative (s). No State can be forced to accept any program decision. The typical regional program needs, specific commission program implementation, institutional constraints to the commission approach, and possible applications of the commission approach to other areas are discussed. (See also W72-10480) (Strachan-Chicago)

W72-10504

REGIONAL PLANNING AND SOCIAL COSTS/BENEFITS, Cornell Univ., Ithaca, N.Y.

C. Riordan.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971, The American Water Resources Association, Urbana, Illinois. 1972. p 176-178. 1 tab.

Descriptors: *Regional analysis, *Regional development, *Planning, *Cost-benefit theory, Decision making, Measurement evaluation, Assessments, Value, Institutional constraints, Technology, Analysis.

Identifiers: Identification, Institutional structure, Commissions, Socio-economic environment.

Three major problems related to attempts to incorporate consideration of social costs and benefits into public decision making are: (1) What are the social costs and benefits of public action. (2) How are the means for measurement of costs and benefits improved once they are identified. (3) How are commensurate values attached to the various kinds of costs and benefits in the assessment process. These questions are problems of identification, measurement, and evaluation. There are three important dimensions which comprehend these actions: institutional structure, technological advance, and analytical capability. The relationship of these factors to commission decision making and to the socio-economic environment in which decisions are made are also considered. (See also W72-10480) (Strachan-Chicago)

W72-10505

CHANGING ROLE OF THE STATE IN WATER RESOURCES PLANNING, Minnesota State Planning Agency, St. Paul.

G. J. Kelnhofer, Jr.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971, The American Water Resources Association, Urbana, Illinois. 1972. p 198-200.

Descriptors: *Water resources development, *Planning, *State governments, *State jurisdiction, Federal government, Project planning, Coordination, Communication, Management, River basin commissions, Water Resources Planning Act.

Identifiers: *Policy making, Joint planning.

The union of the states and the federal government in planning for the development of water and related land resources is still far from an accomplished fact. Some of the problems which must be resolved in achieving the goal of joint planning are: representation of the interests of those who live in the planning area, and the difference in commission roles between a state and federal representative. For many states, active participation in water resources planning is of recent origin. Federal agencies have been somewhat more aggressive than the states in planning water development projects, even on intrastate rivers. Since the federal agencies were better equipped, trained, budgeted and authorized to perform development work, there was little incentive for the state government to duplicate this system with a smaller budget, less manpower, equipment, authority, and experience. At present, an increasingly critical

public attitude is slowly changing this attitude towards development. Federal agencies are more willing to share project planning with state governments. One arena where the state and federal governments are beginning to coordinate their individual approaches to water resources management is that of the river basin commissions authorized under the Water Resources Planning Act of 1965. A dialogue has been started; the participants have measured each other's capacities and evaluated intentions; and slow progress is being made in developing procedures that may yet permit joint planning operations. A new planning partnership is being designed. (See also W72-10480) (Strachan-Chicago)

W72-10506

CASE STUDIES IN REGIONAL WATER QUALITY MANAGEMENT, Cornell Univ., Ithaca, N.Y.

G. Johnson.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971, The American Water Resources Association, Urbana, Illinois. 1972. p 209-210.

Descriptors: *Water quality control, *Management, *Regional development, *Planning, Pollution abatement, Flexibility, Costs, Funding.

Identifiers: *Regional planning, *Policy making, Case studies, Goals, Participation.

Regional surface water quality management studies are discussed. Studies of (1) water resource management policies that conflict with regional goals of efficient and effective water quality restoration and protection, and (2) ways in which general methods of soliciting local and regional participation may fail, are considered. The first study involved a river basin that was being reviewed by the state's department of health prior to establishment of stream quality standards. It recommended a staging of water quality restoration activities with emphasis on 'individual case' stream standards assessments; with priorities established for short term control methods for gross pollution control and long term investments for complete and reliable wastewater collection; and with partial management responsibilities delegated to regional representatives to provide for local input and to foster regional involvement in the management program. After much of the quality attainment should be producing noticeable quality improvements, many problems still exist. The second study illustrates the need for flexible and well thought out water quality management policies. It indicated that the regionalization of wastewater collection and treatment facilities at certain locations in the basin would provide effective water pollution abatement at lower overall costs to the communities in these areas. It was later realized that the idea of regionalization conflicted directly with the then present state treatment facility grant program, controlled by a different agency. (See also W72-10480) (Strachan-Chicago)

W72-10507

THE HUDSON VALLEY COMMISSION - AN EXPERIMENT IN ENVIRONMENTAL PLANNING, Wirth-Howlett Associates, Nanuet, N.Y.

B. Howlett.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971, The American Water Resources Association, Urbana, Illinois. 1972. p 214-215.

Descriptors: *Planning, *Environment, *Hudson River, Jurisdiction, Regulation, Communication, Comprehensive planning, Land use.

Identifiers: *Hudson River Valley Commission, Project review, Resource inventory.

WATER RESOURCES PLANNING—Field 06

Evaluation Process—Group 6B

The Hudson River Valley Commission was formed from a recommendation of a previous commission (1965) which proposed the establishment of an interstate compact. It would be concerned with scenic, historic, recreational and natural values of the River, and not apply directly to water. The Commission had the new and innovative power of reviewing proposed projects, and this was coupled with a unique jurisdictional boundary. The jurisdiction of the Commission within which project review was to be applied was an undulating boundary including all lands within one mile of the Hudson's shores plus any additional lands that could be seen from the water - but not beyond two miles. Two tasks were immediately faced: to create a draft set of project review rules and regulations to be presented at public hearings which were required before reviews could commence, and to make an inventory of significant resources for the entire jurisdiction. While the resource inventory proved a useful tool, methods for scientifically evaluating the full impact of any type of project on these resources proved elusive. The project review procedure proved to be generally successful. Throughout, there was a strong program to relate the Commission goals and activities to local people, in government and outside. Other tasks were less successful, particularly the completion of the comprehensive plan. The Commission's experience indicated that the concept of the comprehensive plan needed to be revamped. Traditional broad land use designations will not succeed without enforcement power, nor does the approach fit particularly well in a strong environmental context. (See also W72-10480) (Strachan-Chicago) W72-10508

THE NORMATIVE ASPECTS OF ENVIRONMENTAL PLANNING, Cornell Univ., Ithaca, N.Y.

P. L. Bereano.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971, The American Water Resources Association, Urbana, Illinois. 1972. p 216-219. 14 ref.

Descriptors: *Environment, *Planning, *Decision making, Ecology, Economics, Public health, Values.

Identifiers: *Normative aspects, Public participation.

The nature of the planning process and its application to environmental concerns are discussed. The origins of American planning are to be found in the upper middle-classes of the Progressive era. Within the last decade, planning has been conceived as a science of rational social decision making. It has embraced the theories of model building, systems analysis, new data handling techniques, the adaptation of behavioral theories, and decision making hypotheses. There has been a transition away from concentrating on the plan to the planning. Further trends can be perceived as focusing on the outcome of decisions. Motivations which have stimulated public planning have shifted from a consideration of economics and public health, to ecology. A problem of major importance which is confronted by environmental planning is presented by local parochialism in the context of issues or development activities which have an impact beyond the particular locale. On the Federal level, there has been increased recognition that a national land use program is needed. The normative issues of what values goals shall embody and what values shall be incorporated into the means of obtaining these goals, must be addressed, or the planning process will have no meaning. (See also W72-10480) (Strachan-Chicago) W72-10509

WATER RESOURCE MANAGEMENT AND THE ENVIRONMENT: A COMPARISON OF

GOVERNMENTAL APPROACHES IN PUERTO RICO AND SOUTHEAST NEW ENGLAND, Institute of Public Administration, Wash., D.C. R. S. Fosler.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971, The American Water Resources Association, Urbana, Illinois. 1972. p 229-232. 1 ref.

Descriptors: *Water resources development, *Management, *Environment, *Puerto Rico, *Governments, Comprehensive planning, Regional planning, Economics, Land use, Population, Regulation.

Identifiers: *Southeast New England, Policy making, Policy implementation, New England River Basins Commission.

Both Puerto Rico and Southeast New England face the same type of conceptual problem for water resource management by current modes of economic activity and patterns of land use which threaten environmental values. In both cases, the presumptive rigor of dealing only with water related problems has given way to a more realistic perspective which deals comprehensively with environmental management. In Puerto Rico, established industrial practices of resource use, high aspirations, and continuing economic problems, all militate against careful environmental use and in favor of continued economic expansion. In Southeast New England the environmental issue is based upon the growth of population and metropolitan areas, and increased economic activity. A top level Environmental Quality Board was created in Puerto Rico, with powers of planning, policy making, policy implementation, and regulation in matters relating to the environment. The New England River Basins Commission was created in response to a need for more effective management of water and related land resources on a region-wide basis. A contrast in problems and approaches is revealed. Puerto Rico appears to face more severe conflicts between economic growth and environmental protection than does Southeast New England. Puerto Rico has fashioned a structurally simple and potentially powerful government apparatus to confront these problems. In Southeast New England the government machinery grows more complex and the potential for definitive action more distant. (See also W72-10480) (Strachan-Chicago)

W72-10508
W72-10512

IN THE YEAR 2070,
Food and Agriculture Organization of the United Nations, Rome (Italy). Policy Advisory Bureau. W. H. Pawley.

Ceres: FAO Review, Vol. 4, No. 4, p 22-27, 1971. 3 tab, 4 ref.

Descriptors: *Tropical regions, *Human populations, *Arid lands, *Crop production, *Desalination, Planning, Economic impact, Growth rates, Migration, Mortality, Productivity, Social aspects, Standing crops, Supply.

Identifiers: *Developing nations, *World hunger, *Overpopulation.

No one can predict what the human population will be in the year 2070, a century from now, but it is possible to develop reasonable growth rate hypotheses. Using a 'moderate' hypothesis, that fertility declines rapidly enough to offset mortality declines and shifts in the age composition in the female population during the fertility period, the world will need to feed 36 billion people by 2070. This may create problems of food supply, but it can be done, and without recourse to synthetic foods if 2 major technical breakthroughs were to occur: (1) techniques for continuous cultivation of the soil in the humid tropics after the tree cover has been removed; (2) desalination of sea water at costs low enough for irrigation and with power cheap enough to pump it hundreds of miles and lift it to considerable heights. If a total world cropping area of 12 billion ha were assumed, and yield

averaged only twice those now attained in Europe, total food output would be at least 30 and probably 50 times the present levels. Some problems are that the new high food producing areas and population concentrations would be considerably separated, the breakthrough might not come soon enough, the enormous amount of chemicals required for such a crop output, the difficulty of educating such large amounts of people and the shortage of disposable income. Solutions to these problems are considered attainable. (Casey-Arizona) W72-10512

IRRIGATION DEVELOPMENT IN THE CENTRAL BASIN OF THE OGALLALA FORMATION—THE PAST AND THE FUTURE,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics; and Haile Sellasie I Univ., Alem Maya (Ethiopia). Dept. of Agricultural Economics.

For primary bibliographic entry see Field 03F.

W72-10512

PLANNING FOR WATER AND POWER UTILISATION,
Snowy Mountains Hydro-Electric Authority, Cooma (Australia).

For primary bibliographic entry see Field 03F.

W72-10532

GENERALIZATION OF WHITE'S METHOD OF SUCCESSIVE APPROXIMATIONS TO PERIODIC MARKOVIAN DECISION PROCESSES,
Sun Oil Co., Dallas, Tex.

For primary bibliographic entry see Field 06A.

W72-10708

ANALYSIS OF WATER REUSE ALTERNATIVES IN AN INTEGRATED URBAN AND AGRICULTURAL AREA,
Water Research Lab, Utah State Univ., Logan.

For primary bibliographic entry see Field 05D.

W72-10781

ROLE OF ECONOMICS IN PLANNING FLOOD PLAIN LAND USE,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center. L. D. James.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 98, No. HY6, p 981-992, June, 1972. 2 fig, 8 tab, 8 ref.

Descriptors: *Flood control, *Flood plains, *Floodproofing, *Flood protection, *Flood plain zoning, Flood damage, Land use, Planning, Optimization, Estimating, Computer programs, Non-structural alternatives, Flood plain insurance, Hydraulics, Systems analysis.

Identifiers: Economic analysis, Peak flow.

Economic analysis can be employed to formulate a plan combining nonstructural with structural measures for flood control. Planning decision on whether development should be permitted in a flood plain can be integrated with decisions on how to arrange, design, use, and maintain those developments that are authorized. To illustrate the computational approach for establishing planning guidelines, a hypothetical simplified situation is examined in a procedure described step by step in a numerical example; a methodology is presented for estimating the optimum nonstructural flood control alternatives for a hypothetical flood plain. The objective is to minimize the sum of expected flood damages and the annual cost of the employed measures. It is shown that flood proofing has the economic advantage for shallow (more frequent) flooding, and flood zoning has the advantage for deeper (rarer) flooding. The least cost design for nonstructural flood control is thus to floodproof the portion of the flood plain which will

Field 06—WATER RESOURCES PLANNING

Group 6B—Evaluation Process

be inundated by the design flood to depths of less than 1.43 m and excluding development by zoning from areas flooded to a greater depth. References are made to literature and computer programs for dealing with data gathering and analysis in more complex, real world situations. (Bell-Cornell) W72-10782

ECONOMIC OPTIMIZATION OF A SINGLE-CELL AQUIFER,
Washington Univ., Seattle. Dept. of Economics.
For primary bibliographic entry see Field 04B.
W72-10783

PLANS FOR MEETING WATER REQUIREMENTS, IN THE KASKASKIA RIVER BASIN, 1970-2020,
Illinois State Water Survey, Urbana.
K. P. Singh, A. P. Visocky, and C. G. Lonnquist.
Report of Investigation 70, 1972. 24 p, 11 fig, 11 tab, 12 ref.

Descriptors: *Water treatment, *Water supply, *Water requirements, *Costs, Planning, Optimization, Mathematical models, Lake Superior, Computer programs, Groundwater availability, Surface water availability, Storage tanks, Reservoir yield, System analysis.
Identifiers: *Kaskaskia River Basin, Raw water, Population growth, Transmission costs (Water), Water production costs, Treatment costs.

The availability of ground and surface water sources is assessed and cost optimization is performed to provide an adequate and economical water supply for each of 105 towns in the Kaskaskia River Basin from 1970 through the year 2020. An analysis of town water requirements and populations yields a stable relation, enabling transformation of population estimates to water requirement estimates for the 60-year period. Three types of water sources, in the face of general constraints, are considered: groundwater from drift and shallow bedrock wells; surface water from existing and potential reservoirs; water from the Kaskaskia River. Cost elements of a water supply system, for which appropriate cost functions are provided, were grouped under costs of raw water production, treatment, and transmission to storage tank location. Minimum-cost water supply systems are obtained by optimizing the sum of these three costs. Only 50 towns in the basin have adequate groundwater potential to meet the 2020 requirements. Groundwater supply is generally more economical than water supply from reservoirs. Two alternative economical plans for meeting the water requirements of the 105 towns are provided; the plans are described and discussed in terms of adequacy are economic efficiency. (Bell-Cornell)
W72-10785

REGIONAL SEWERAGE SYSTEMS AND TREATMENT COSTS IN TEXAS,
Texas Water Quality Board, Austin.
For primary bibliographic entry see Field 05D.
W72-10853

IRRIGATION PLANNING 4. OPTIMAL INTER-SEASONAL WATER ALLOCATION,
Montana State Univ., Bozeman. Dept. of Economics; and Montana State Univ., Bozeman. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W72-10890

A METHODOLOGY STUDY TO DEVELOP EVALUATION CRITERIA FOR WILD AND SCENIC RIVERS, REPORT OF FOREST SUB-PROJECT,
Idaho Univ., Moscow. Water Resources Research Inst.
For primary bibliographic entry see Field 04A.
W72-10897

A GENERALIZED MODEL OF A RESOURCE-POPULATION SYSTEM: I. GENERAL PROPERTIES,

Cornell Univ., Ithaca, N.Y. Div. of Biological Sciences.
For primary bibliographic entry see Field 06A.
W72-10939

A GENERALIZED MODEL OF A RESOURCE-POPULATION SYSTEM: II. STABILITY ANALYSIS,

Cornell Univ., Ithaca, N.Y. Div. of Biological Sciences.
For primary bibliographic entry see Field 06A.
W72-10940

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

DEVELOPMENT OF A STATE EFFLUENT CHARGE SYSTEM,
Vermont Dept. of Water Resources, Montpelier. Agency of Environmental Conservation.
For primary bibliographic entry see Field 05G.
W72-10674

6D. Water Demand

THE DEVELOPMENT OF A PROCEDURE FOR ACQUIRING AND DISSEMINATING INFORMATION ON WATER USE, VOLUMES, 1 AND 2,

Enviro Control, Inc., Washington, D.C.
For primary bibliographic entry see Field 07A.
W72-10467

WATER FOR SOUTHERN NEVADA: PART 1,
Montgomery (James M.) Consulting Engineers, Inc., Pasadena, Calif.
For primary bibliographic entry see Field 04B.
W72-10471

IN THE YEAR 2070,
Food and Agriculture Organization of the United Nations, Rome (Italy). Policy Advisory Bureau.
For primary bibliographic entry see Field 06B.
W72-10512

AGRICULTURE'S CONTRIBUTIONS TO THE NATION'S WATER RESOURCES AND FLOOD CONTROL,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 03F.
W72-10520

PLANS FOR MEETING WATER REQUIREMENTS, IN THE KASKASKIA RIVER BASIN, 1970-2020,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 06B.
W72-10785

ST. LOUIS REGION WATER AND SEWERAGE FACILITIES,

D. A. Sokol, and T. L. Appell.
Available from the National Technical Information Service as PB-205 978, \$3.00 in paper copy, \$0.95 in microfiche. East-West Gateway Coordinating Council, St. Louis, Missouri, September 1971. 354 p, 21 fig, 30 tab, 65 ref. HUD Mo. P-160, Work Element.

Descriptors: *Comprehensive planning, *Water supply, *Sewerage, *Urban drainage, *Regional development, *Water resources development, Urbanization, Cities, Planning, Storm runoff, Treatment facilities, Missouri, Illinois, Comparative costs, Capital costs, Water policy, Coordination, Local governments.

Identifiers: *St. Louis (Missouri), Water and sewerage facilities.

Analyses and recommendations are presented for an areawide water, sewer, and stormwater drainage facilities development plan for the St. Louis Metropolitan area. Three geographical sectors comprise the study area: (1) the urbanized area in St. Louis and St. Louis County, (2) the Missouri counties of Franklin, Jefferson and St. Charles, and (3) the Illinois counties of Madison, Monroe and St. Clair. All water and sewerage treatment facilities as small as those serving a population of 100 people and larger were inventoried. This detailed inventory identifies the capacity each plant was designed to serve, the present loading on the plant in absolute numbers and percentage of design capacity, and the level or quality of treatment. Existing facilities for water supply, sanitary sewage treatment and storm drainage were analyzed in detail by Sectors of the Region. It was concluded that seventy percent of the water supply facilities in the region will require modification within the next 15 years. Wastewater collection and disposal was identified as an increasingly difficult problem in the region. Several parts of the study area face the problem of providing sewage treatment facilities to eliminate problems resulting from malfunctioning septic tanks. Regional integrated approaches are suggested for providing and operating facilities for water supply, sewerage and stormwater drainage. Economics in the scale of construction of large joint-use facilities and systems, as contrasted with smaller facilities of single jurisdictions, are documented. (Poertner) W72-10846

NORTH ATLANTIC REGIONAL SUPPLY MODEL,
Meta Systems, Inc., Cambridge, Mass.
For primary bibliographic entry see Field 06A.
W72-10886

MODEL FOR ESTIMATING REGIONAL WATER NEEDS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W72-10887

THE NAR STUDY: A CASE STUDY IN SYSTEMS ANALYSIS,
Corps of Engineers, New York. North Atlantic Div.
For primary bibliographic entry see Field 06A.
W72-10888

GROUND-WATER RESOURCES OF THE YUCCA VALLEY-JOSHUA TREE AREA, SAN BERNARDINO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 04B.
W72-11070

TEN COUNTIES INVESTIGATION--MUNICIPAL, INDUSTRIAL, AND AGRICULTURAL WATER DEMAND IN COLUSA, GLENN, HUMBOLDT, LAKE, MARIN, MENDOCINO, NAPA, SOLANO, SONOMA, AND YOLO COUNTIES,
California State Dept. of Water Resources, Sacramento.
M. Roos, W. D. Walling, R. R. McGill, Jr., and C. M. Warner.

Available from State of Calif., Documents Section, PO Box 20191, Sacramento, Calif. 95820 \$2.00. California Department of Water Resources, Bulletin No 184, December 1971. 84 p, 12 fig, 36 tab.

Descriptors: *Water resources development, *Water supply, *Water demand, *Projections, *California, Regions, Water users, Data collec-

WATER RESOURCES PLANNING—Field 06

Nonstructural Alternatives—Group 6F

tions, Surface waters, Streams, Groundwater, Water wells, Reservoirs, Water yield, Irrigation, Industrial water, Municipal water, Crops, Hydrologic data, Costs.

Future water demands for municipal, industrial, and agricultural purposes are projected for 10 counties in northwestern California—Colusa, Glenn, Humboldt, Lake, Marin, Mendocino, Napa, Solano, Sonoma, and Yolo Counties. The sources of additional water supply include the development of groundwater, surface water on local streams, and the Upper Eel River. The additional water supplies needed in the ten-county area in the year 2020 to satisfy municipal, industrial, and agricultural demands would amount to about 990,000 acre-feet. (Woodard-USGS)
W72-11075

6E. Water Law and Institutions

WHERE CAN WE GO WITH PUBLIC PARTICIPATION IN THE PLANNING PROCESS, Colorado State Univ., Fort Collins.

N. Wenger.

In: Proceedings of the Symposium on Social and Economic Aspects of Water Resources Development, Cornell University, Ithaca, N.Y., June 21-23, 1971. The American Water Resources Association, Urbana, Illinois, p 9-18. 13 ref, 1972.

Descriptors: *Planning, *Decision making, Administration, *Political aspects, Cooperation, Public rights.

Identifiers: *Public participation, Opinions, Interest groups.

Some questions involving public participation in the planning process are: (1) Who should participate. (2) Who will participate., (3) How much participation is desirable., (4) On what issues should there be citizen participation., (5) How should the expressed views be weighted., (6) Does residence in a particular area increase the importance of participation., (7) What weight should be given to the expression of organized and articulate interest groups. Any scheme for participation in the administrative process (including planning) will have to resolve the question of how public participation can be related to the regularly constituted political representative system and the decisions that the system makes. It must also deal with the problems of the silent majority. It must face the issue of weighing the various views and opinions, distinguishing between private preferences and public interests. A scheme for participation cannot avoid the dilemma of cooperation and manipulation of public support by disseminating colored or selective information, winning support by favors, and otherwise influencing outcomes. Finally, such a scheme must decide who may participate in the planning process from the general public and must establish a procedure to record the public opinion. (See also W72-10480) (Strachan-Chicago)
W72-10482

CAN CITIZENS INVENT THEIR FUTURE. — CASE STUDY OBSERVATIONS OF PUBLIC PARTICIPATION IN ENVIRONMENTAL MANAGEMENT, Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 06B.
W72-10487

CASE STUDY: STIMULATING COMMUNITY INVOLVEMENT: BRINGING TO PUBLIC DECISION MAKERS THE POINT OF VIEW OF PRIVATE CITIZENS, Water Resources Association of the Delaware River Basin, Philadelphia, Pa.
For primary bibliographic entry see Field 06B.
W72-10488

AN INNOVATIVE EDUCATIONAL EFFORT TO EXPLORE WAYS OF IMPROVING LOCAL DECISIONS AFFECTING ENVIRONMENTAL QUALITY,

Cornell Univ., Ithaca, N.Y.

For primary bibliographic entry see Field 06B.

W72-10493

THE COMMISSION FORM OF POLICY DETERMINATION: IS THE PUBLIC INVOLVED.,

Cornell Univ., Ithaca, N.Y.

For primary bibliographic entry see Field 06B.

W72-10496

JAMAICA BAY/KENNEDY AIRPORT ANATOMY OF A TECHNOLOGICAL ASSESSMENT, National Academy of Sciences, Wash., D.C.

For primary bibliographic entry see Field 06B.

W72-10501

EXPERIENCE OF THE CORPS OF ENGINEERS IN PREPARING ENVIRONMENTAL IMPACT STATEMENTS,

Institute for Water Resources (Army), Alexandria, Va.

For primary bibliographic entry see Field 06B.

W72-10503

CHANGING ROLE OF THE STATE IN WATER RESOURCES PLANNING, Minnesota State Planning Agency, St. Paul.

For primary bibliographic entry see Field 06B.

W72-10506

THE HUDSON VALLEY COMMISSION - AN EXPERIMENT IN ENVIRONMENTAL PLANNING,

Wirth-Howlett Associates, Nanuet, N.Y.

For primary bibliographic entry see Field 06B.

W72-10508

ENVIRONMENTAL POLLUTION AND TEXAS LAW,

Texas Univ., Austin. Science Education Center.

For primary bibliographic entry see Field 05G.

W72-10517

STATE AGENCIES REGULATING CONFINED ANIMAL FEEDING OPERATIONS,

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 05G.

W72-10538

SURVEY OF THERMAL RESEARCH PROGRAMS SPONSORED BY FEDERAL, STATE, AND PRIVATE AGENCIES (1970), Oak Ridge National Lab., Tenn.

For primary bibliographic entry see Field 05G.

W72-10555

NATIONAL GOALS, STATE'S INTERESTS, AND JURISDICTIONAL FACTORS,

Scripps Institution of Oceanography, La Jolla, Calif.

For primary bibliographic entry see Field 06G.

W72-10576

ROLE OF REMOTE SENSING IN DEVELOPING COUNTRIES.

Agency for International Development, Washington, D.C. Office of Science and Technology.

For primary bibliographic entry see Field 07B.

W72-10631

DEVELOPMENT OF A STATE EFFLUENT CHARGE SYSTEM,

Vermont Dept. of Water Resources, Montpelier.

Agency of Environmental Conservation.

For primary bibliographic entry see Field 05G.

W72-10674

LIVESTOCK INDUSTRIES IN TEXAS AS RELATED TO WATER QUALITY, REPORT NUMBER ONE,

Texas Water Quality Board, Austin.

For primary bibliographic entry see Field 05C.

W72-10854

A SUMMARY OF WATER POLLUTION CONTROL IN THE STATE OF TEXAS.

Texas Water Quality Board, Austin.

Texas Water Quality Board, Austin, 1970. 37 p.

Descriptors: *Water quality, *Texas, *Water pollution control, *Planning, *History, Legislation, Water quality act, Construction law, Legal aspects, Recreational facilities, Transportation. Identifiers: Texas Water Pollution Control Board, Development.

This summary gives a historical account of how water pollution control has evolved in the state of Texas. The historical account leads up to the enactment in 1961 of the Texas Water Quality Act. This act is the basic Texas statute on water quality and pollution control. It expresses the state policy with regard to water quality control, creates the Texas Water Quality Control Board, outlines a system for water quality control, coordinates water quality control programs of various state agencies and local governments, and provides a basis for coordinating water quality control programs of the State of Texas with those of the Federal government. This statute has since been amended and additional ones have been enacted to strengthen the state's control over pollution and water quality. The Texas Water Quality Board supervises the field of water quality and its responsibilities are broken down into five categories: Field Operations, Control Operations, Administrative Services, Consulting Services, and Hearings and Enforcement. The purpose of this summary is so that citizens of Texas will know of and better understand the past, present, and future water pollution control activities of the State of Texas. (Poertner)

W72-10856

PUBLIC HEALTH SERVICE DRINKING WATER STANDARDS--1962.

Public Health Service, Rockville, Md.

For primary bibliographic entry see Field 05G.

W72-11076

6F. Nonstructural Alternatives

ROLE OF ECONOMICS IN PLANNING FLOOD PLAIN LAND USE,

Georgia Inst. of Tech., Atlanta. Environmental Resources Center.

For primary bibliographic entry see Field 06B.

W72-10782

TEN COUNTIES INVESTIGATION--MUNICIPAL, INDUSTRIAL, AND AGRICULTURAL WATER DEMAND IN COLUSA, GLENN, HUMBOLDT, LAKE, MARIN, MENDOCINO, NAPA, SOLANO, SONOMA, AND YOLO COUNTIES,

California State Dept. of Water Resources, Sacramento.

For primary bibliographic entry see Field 06D.

W72-11075

Field 06—WATER RESOURCES PLANNING

Group 6G—Ecologic Impact of Water Development

6G. Ecologic Impact of Water Development

ENVIRONMENTAL, ECONOMIC AND SOCIAL ASPECTS OF THE CROSS FLORIDA BARGE CANAL.
Army Engineer District, Jacksonville, Fla.
For primary bibliographic entry see Field 06B.
W72-10499

TOWARD A THEORY OF COMPROMISE IN ENVIRONMENTAL DISPUTES.
Connecticut Univ., Storrs.
For primary bibliographic entry see Field 06B.
W72-10500

EXPERIENCE OF THE CORPS OF ENGINEERS IN PREPARING ENVIRONMENTAL IMPACT STATEMENTS,
Institute for Water Resources (Army), Alexandria, Va.
For primary bibliographic entry see Field 06B.
W72-10503

ECOLOGICAL HAZARDS OF THE SNOWY MOUNTAINS SCHEME.
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
A. B. Costin.
Ecological Society of Australia, Proceedings, Vol. 5, p 87-98, 1970. 1 fig, 15 ref.

Descriptors: *Scenery, *Water resources development, *Planning, *Irrigation water, *Hydroelectric power, *Ecology, Physiographic provinces, Land use, Social aspects, Natural resources, Surveys, Watershed management, Australia, Environmental effects.
Identifiers: Snowy Mountains Scheme (Australia).

The Snowy Mountains Scheme covers a wide range of environments from subhumid lowlands to cold wet alpine conditions. Ecologically, the existing hazards include the high incidence of frosts and heavy rain, deeply erodible soils, prevalence of fires and the existence of summer grazing. The Snowy Mountains Authority has contributed to much environmental disruption, especially erosion, and alternatively has minimized much damage by enlightened soil conservation, grazing and fire protection policies. It appears that the Authority's limited terms of reference resulted in the degradation of many resources not directly concerned with economic water values. The region is a major experiment in both resource development and the preservation of natural and scenic values. Many of the disadvantages of the Snowy Mountains Scheme to ecological values could have been minimized and many of the potential advantages increased by wider planning for ecological as well as engineering values. The starting point for such planning should have been surveys of all the main features of the area-flora, fauna, soils, scenery and existing and potential land-use, as well as the surveys of climate, geology, topography and hydrology carried out specifically for the hydroelectric and irrigation works. (Casey-Arizona)
W72-10533

POTENTIAL ENVIRONMENTAL MODIFICATION PRODUCED BY LARGE EVAPORATIVE COOLING TOWERS.
EG and G Inc., Boulder, Colo. Environmental Services Operation.
For primary bibliographic entry see Field 05C.
W72-10548

GEOOTHERMAL RESOURCES IN CALIFORNIA—POTENTIALS AND PROBLEMS,
California Inst. of Tech., Pasadena. Environmental Quality Lab.
M. Goldsmith.
EQL Report No 5, December 1971. 45 p, 4 fig, 37 ref. NSF GI-29726.

Descriptors: *Electric power, Economics, Environmental effects, California, Desalination, Cooling towers, Heated water, Land subsidence, Seismic waves, Air pollution, *Geothermal studies, *Resources development.

Identifiers: *Geothermal resources, *Geysers, *Imperial Valley (Calif), Dry steam.

The technology, cost and potential of geothermal resources in California are examined. The two forms in which the nature of the geothermal resource manifests itself are dry steam and very hot water in the ground. The per megawatt investment in a Geyser's geothermal plant is substantially less than that for a modern fossil plant and fuel, and operating costs are about 85 percent of those for a modern fossil plant. Environmental effects of a geothermal power plant include intrusion of an industrial operation into non-industrial areas, discharge of surplus hot water which may be high in mineral contents, land subsidence, seismic activity and well blow out. Noxious gases are often a by-product of geothermal wells. The non-condensable gases constitute from 0.2 to 1.8 percent of the steam flow at The Geysers. Present geophysical evidence indicates that the possibility for supplementing Southern California electric growth over the next 10 or 20 years might be met by the geothermal resources of the Imperial Valley. (Upadhyaya-Vanderbilt)
W72-10550

PROBLEMS AND PROSPECTS FOR NUCLEAR POWER,
Bechtel Corp., San Francisco, Calif.
W. K. Davis.
Chemical Engineering Progress, Vol 66, No 2, p 15-21, February 1970. 4 photos.

Descriptors: *Nuclear powerplants, Thermal pollution, Permits, Costs, Heavy water, Fuels, Safety.

Identifiers: Public relations, Uranium enrichment, Fast breeder reactor, Gas centrifuge.

About 70,000 MW of nuclear power are on order or under construction in the U.S. Almost all the 70 gigawatts now committed will be completed by 1975 and it is expected that the total in the U.S. by 1980 will be in excess of 150 gigawatts. The costs of nuclear plants have been increasing at a high rate because of the increase in construction labor rates and declining labor productivity. The advantages of nuclear powerplants over other powerplants are in the areas of air pollution, noise and appearance. Problems of public relations, licensing and regulation and provision of uranium enrichment services are associated with nuclear power. Water cooled reactors increase the thermal effects problem in some areas by discharging up to 60 percent more waste heat into the cooling water than fossil fuel fired plants. The entire free world will require 37,000 metric tons per year of enriched uranium by the year 1980. The present free world enriching capacity is roughly 20,000 metric tons per year. There is great interest abroad in the gas centrifuge process for enriching uranium. Liquid sodium cooled fast breeder reactors seem economically competitive. (Upadhyaya-Vanderbilt)
W72-10557

THE ENVIRONMENTAL CHALLENGE—VALUES IN CONFLICT,
Westinghouse Electric Corp., Philadelphia, Pa. Environmental Systems Dept.
For primary bibliographic entry see Field 05G.
W72-10558

INTRODUCTION TO: COASTAL ZONE MANAGEMENT: MULTIPLE USE WITH CONSERVATION,
J. F. P. Braatz.

In: Coastal Zone Management: Multiple Use With Conservation, University of California Engineering and Physical Sciences Extension Series, John Wiley and Sons, Inc., New York, N.Y. 1972. p 1-18. 1 tab, 2 fig.

Descriptors: *Planning, *Resources development, Control, Jurisdiction, Geology, Biological properties, Meteorology, Social aspects, Political aspects, Economics.

Identifiers: *Policy making, *Coastal zone management, *Marine resources, Implementation, Use, Intensification factors.

Issues and problems of coastal zone management are outlined. A major section of the national environment and resources is the coastal zone which is the staging ground for use of marine resources and constitutes all access to the oceans and Great Lakes. Problems in the coastal zone stem from the multiple use of the coastal resources and are sufficiently diffused throughout the national, social, and economic structure to require a unified and integrated resolution similar to that used for national environmental problems. The nature and scope of the coastal zone management problem include considerations of: geological characteristics, biological characteristics, meteorological characteristics, coastal zone use and activities, intensification factors, and various social, political, and economic factors. Development planning for the coastal zone should be performed with local interests, needs, constraints and opportunities carefully considered within the framework of national policy and objectives with broad and long-range interests of the nation governing. The essential management functions of planning, implementing, and controlling operations must be provided for in a unified management system linking national, state, and local jurisdictions. The book Coastal Zone Management: Multiple Use with Conservation, is designed to provide the essential content for rational development planning for the coastal zone. (See W72-10576 thru W72-10584) (Strachan-Chicago)
W72-10575

NATIONAL GOALS, STATE'S INTERESTS, AND JURISDICTIONAL FACTORS,
Scripps Institution of Oceanography, La Jolla, Calif.

W. A. Nierenberg.
In: Coastal Zone Management: Multiple Use with Conservation, University of California Engineering and Physical Sciences Extension Series, John Wiley and Sons, Inc., New York, N.Y. 1972. p 21-34. 7 ref.

Descriptors: *Governments, *Jurisdiction, *Oceanography, *Research and development, *Technology, Planning, Political aspects, Economics, Pollution abatement.

Identifiers: *Research freedom, Nationalism, Coastal zone management.

The development of oceanography is reviewed from the laying of the Atlantic cable. The more than one hundred year period since the laying of the cable constitutes the early history of oceanography. The second period commenced with the Deep Sea Drilling Project, which marked the first profound physical sampling of the ocean basins. The imaginative and exciting ideas of oceanographers have not been employed in the field of coastal zone management. Mounting public pressure and concern for the fate of the nation's coastlines will result in the use of more ingenuity and technology than has been used to date. The oceanographer no longer has freedom of scientific investigation of the ocean. Nationalism has defined and redefined the baseline for the calculation of the territorial limits of each country. Permission to conduct research on the continental shelf has not been readily given under the Conventions of Geneva. Consequently, routine surveys

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which must be planned in advance are frequently hindered by bureaucratic obstacles. Working oceanographers are somewhat hesitant about the future of their research. Many of the developing nations, particularly in South America, are limiting the oceanographer's freedom, because they are afraid that the larger nations, which possess the technology to exploit the ocean's wealth, will impede their own economic development. Significant international action is needed to develop the economic potentiality of the ocean basins, and to stop the pollution of the ocean. (See also W72-10575) (Strachan-Chicago) W72-10576

CONSERVATION OF BIOLOGICAL RESOURCES OF THE COASTAL ZONE, California Univ., Berkeley.

M. B. Schaefer.

In: Coastal Zone Management: Multiple Use With Conservation, University of California Engineering and Physical Sciences Extension Series, John Wiley and Sons, Inc., New York, N.Y. 1972. p 35-79. 1 tab, 25 ref.

Descriptors: *Conservation, *Resources development, *Planning, *Decision making, Management, Ecology, Coordination, Governments, Political aspects.

Identifiers: *Biological resources, *Coastal zone use, Resource ownership, Special interest groups.

Conservation refers to: (1) maintaining the living resources in that state where they are well above the critical zone, avoiding irreversibilities, and (2) establishing some acceptable state of conservation of ecosystems, and of each of their living components, within that boundary condition. A classification of man's uses of the coastal zone helps to identify the specific nature of conservation problems. Man directly uses the living resources for food extraction, recreation extraction and such non-extractive uses as observation. Some uses of the resources which depend on the biota are waste disposal of biodegradable wastes and biological extraction of inorganic materials. Human activities which incidentally affect, or are affected by, the biota include uses of marginal lands, solid waste disposal and sanitary fill, building sites, airports, harbor construction, modification of shoreline for recreation, beach erosion and maintenance, waste disposal—nonbiodegradable wastes, ocean shipping, pipelines, power generation, ocean mining, shoreside recreation, communications, and military defense. All these uses of the coastal zone are discussed individually and in detail. Conservation demands planning and decision making in the context of the total ecology of this region. Planning problems include ownership of the resources, coordination of a total environmental approach among local, state and national governments, and the domination of these problems by special interest groups. (See also W72-10575) (Strachan-Chicago) W72-10577

SOCIAL NEEDS AND THE URBAN-MARINE ENVIRONMENT, Resources for the Future, Inc., Washington, D.C. M. Clawson.

In: Coastal Zone Management: Multiple Use With Conservation, University of California Engineering and Physical Sciences Extension Series, John Wiley and Sons, Inc., New York, N.Y. 1972. p 80-104. 11 ref.

Descriptors: *Recreation demand, *Social aspects, *Planning, *Resources development, Demand, Quality control, Management.

Identifiers: *Urban-marine environment, Socioeconomic trends, Life style, Affluence.

Postwar socioeconomic trends are producing new demands on natural resources. These demands are not unmangeable, if the thought and effort is exerted to cope with them. Among the socioeconomic trends are population growth,

changes in the population geographic distribution, changes in birth and death rates, population movement toward urban complexes, increase in family income, the rise of recreation expenditures, increase in leisure time, and increase in production and in distribution of knowledge. Americans are developing a new life style evidenced in a developing suburban life, volume of consumption gadgets, increase in education, and increase in travel. The rising affluence of the American people begs the question as to whether the nation's natural resources are sufficient to meet the demands. There is sufficient quantity, but the quality poses real problems. Outdoor recreation is discussed in general and in California, as an example of the changing life style and the increased demand on natural resources. The outdoor recreation experience is divided into five phases: (1) planning or anticipation (2) travel from home to the recreation site, (3) activities on-site, (4) travel from site to home, and (5) recollection. Outdoor recreation significantly affects the urban-marine environment. For example, the majority of outdoor recreation in California depends upon the ocean. Every present and potential user of the marine and beach resources must take changing popular attitudes into account in his private calculations. (See also W72-10575) (Strachan-Chicago) W72-10578

TRAFFIC AND TRANSPORT NEEDS AT THE LAND-SEA INTERFACE, Department of Commerce, Washington, D.C. E. M. MacCutcheon.

In: Coastal Zone Management: Multiple Use With Conservation, University of California Engineering and Physical Sciences Extension Series, John Wiley and Sons, Inc., New York, N.Y. 1972. p 105-147. 1 tab, 16 ref.

Descriptors: *Transportation, *Planning, *Decision making, Environment, Oil spills, Social aspects, Conservation, Pollution abatement, Sewage disposal.

Identifiers: *Traffic, *Land-sea interface, *Coastal zone management, Conflicts, Leisure time.

Among the traffic and transport systems which are important to the study of conflicts at the coastal zone are ships, waterborne craft, land vehicles, aircraft, and support systems necessary for the effective locomotion of people. Conflicts are seldom found among the goals or purposes of these various systems, but in their operation. The systems compete with each other and conflict with the environment in response to their needs for sea, land, and air space, and a share of the electromagnetic spectrum. The trouble in dealing with coastal zone interactions is the difficulty of measuring such intangibles as the satisfaction of a swimmer. Three important trends influence the status of traffic and transport at the land-sea interface: (1) population growth, (2) the increasing proportion of leisure time, and (3) increasing public awareness of conservation and the threat of pollution. The most important problems are sewage, signals, and oil spills. The most difficult problem of all is the lack of a system of quantitative values for many of the ecological and social factors which are now in direct competition with private enterprise in the coastal zone. New measures and associated quantities must be devised to manage the public welfare in important planning decisions. Although many problems are involved with coastal zone management, it is clear that the particular problems of traffic and transportation are many. Methods of solution to these problems are largely lacking. (See also W72-10575) (Strachan-Chicago) W72-10579

CONSERVATION OF MINERAL RESOURCES OF THE COASTAL ZONE, California State Lands Commission, Sacramento. F. J. Hortic.

In: Coastal Zone Management: Multiple Use With Conservation, University of California Engineer-

ing and Physical Sciences Extension Series, John Wiley and Sons, Inc., New York, N.Y. 1972. p 149-189. 6 fig, 6 ref, 7 append.

Descriptors: *Conservation, *Mineral industry, Planning, Decision making, Management, Ecology, Economics.

Identifiers: *Coastal zone management, Compatibility matrix, Solutions, Implementation, Security.

Conservation is defined as the result of achieving the best feasible ecological balance while developing the necessary resources for the benefit of man. There is at present little general awareness of the absolute necessity for full mineral development of the offshore to offset otherwise adverse impacts on the economy and the security of the nation, and particularly the economy of the individual coastal state. A one-dimensional graphical analysis of the interrelationships and conflicts of area multiple uses is illustrated by a compatibility matrix. Some typical uses of priority concern include commercial harbors, shipping, petroleum and other mineral production, nuclear power, housing and other real estate development, waste disposal, and recreation. The compatibility terms for uses depicted on the chart are essential, supplemental, mutually exclusive, competitive, and indeterminate. The selection of a specific conservation solution, or range of solutions, for implementation is currently still primarily dependent upon technical and administrative management decision. The appendices include excerpts from public resources code, the permit for the conduct of geophysical surveys on tide and submerged lands of the State of California, and excerpts from the California Administrative Code. (See also W72-10575) W72-10580

SYSTEMS PLANNING AND CONTROL: COASTAL REGIONS, Litton Industries, Inc., Beverly Hills, Calif. D. Sternlight.

In: Coastal Zone Management: Multiple Use With Conservation, University of California Engineering and Physical Sciences Extension Series, John Wiley and Sons, Inc., New York, N.Y. 1972. p 193-220. 13 fig, 15 ref.

Descriptors: *Planning, *Control, *Systems analysis, Economics, Economic efficiency, Economic activity, Structural analysis, Evaluation.

Identifiers: *Coastal zone management, *Systems planning, Stimulation, Problem definition, Systems synthesis, Implementation planning.

The planning of physical and organizational systems for the use of the coastal zone is described. Most of the coastal zone conflicts, which are man-made, can be dealt with through new technology, better planning, and more careful and responsible management. A sequential, evolutionary planning, permits orderly treatment of questions and issues. The process is an iterative one — information developed during later stages is used to check, modify, or repeat earlier stages when a significant improvement can be expected and planning time permits. The main steps in this planning process are: problem definition, structuring, and analysis; systems synthesis; implementation planning and programming; and installation, monitoring, and evaluation. These steps are discussed separately. The preferred technique for guiding systems planning is that of free economic choice. Several methods of control and stimulation are available to the public planner, i.e. direct and indirect. Four examples are given which illustrate the principles discussed. (1) An analysis of the allocation of additional subsidy funds between oil and mineral extraction demonstrates the basic structure of economic choice and economic efficiency. (2) An illustration of scale economies in size or in production reveals one underlying reason for the development of large ships. (3) A comparison of size economies under varying constraints sheds further light on the development of large ships and use (or avoidance) of canals and

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ports. (4) An analysis of costs and benefits provides a mechanism for considering major port developments. (See also W72-10575) (Strachan-Chicago)
W72-10581

INFORMATION SYSTEMS AND DATA REQUIREMENTS: COASTAL DEVELOPMENT PLANNING, Naval Postgraduate School, Monterey, Calif. N. F. Schneidewind.

In: Coastal Zone Management: Multiple Use With Conservation, University of California Engineering and Physical Sciences Extension Series, John Wiley and Sons, Inc., New York, N.Y. 1972. p 221-244. 3 fig, 14 ref.

Descriptors: *Planning, *Data collections, *Networks, Data storage and retrieval, Data transmission, Maintenance, Management.

Identifiers: *Coastal development planning, *Information systems, *Data requirements, *Centralization, Standardization.

The major requirement for the development of a coastal zone data network is the centralization of storage and processing within each state and the provision of interfaces among federal, state, and coastal zone systems so that greater coordination and standardization of data collection and processing may result. The resulting coastal zone network could be characterized as a moderately centralized intrastate system, but as a highly decentralized interstate system. Some of the measures which are needed to develop a coastal zone data network are: (1) development and maintenance of an inventory of coastal zone data, (2) establishment of interstate and intrastate data format and transmission standards, (3) establishment in the states of an organizational structure for facilitating the exchange of data among local, state, and federal agencies and the private sector, (4) establishment of a central data center in each state under state control, (5) development of a consistent method for indexing and storing the data, (6) storage of data in a form which is an analog of the coastal zone for the purposes of efficiency of retrieval and the development of coastal zone models, and (7) establishment of coastal zone data systems, in such areas as water quality, fisheries, coastal engineering, and weather monitoring and forecasting as part of a larger coastal zone data network. (See also W72-10575) (Strachan-Chicago)
W72-10582

OCEAN INSTALLATIONS: STATE OF TECHNOLOGY, Naval Civil Engineering Lab., Port Hueneme, Calif.

J. G. Hammer.

In: Coastal Zone Management: Multiple Use With Conservation, University of California Engineering and Physical Sciences Extension Series, John Wiley and Sons, Inc., New York, N.Y. 1972. p 245-285. 16 fig, 17 ref.

Descriptors: *Planning, *Technology, *Offshore platforms, Decision making, Design criteria, Preservation, Ecology, Coastal structures.

Identifiers: *Ocean installations, *Coastal zone management, Implementation.

The role of ocean installations in the management of the coastal zone, the state of technology, the kinds of ocean installations, the future challenge of moving land-oriented activities offshore, and an example of how the coastal zone might be converted to a land substitute are discussed. Technology for engineering management of the coastal zone has not kept pace with the demands of changing goals. Problems in this field are becoming more complex and difficult, and decisions are frequently made on the basis of an inadequate technology because there is not sufficient time for research and development. More trained people and a more knowledgeable public

are needed. Engineers need improved criteria for designing. Improved techniques are needed to determine the properties of the ocean floor, wave forces and run-up on shore structure, and design waves and their frequency of occurrence. Further developed underwater construction technology and its application to installations in the coastal zone are needed. The challenge to the engineering profession lies in an integrated contribution to coastal zone management demands. Engineers must be concerned with the preservation of the ecological systems. Finally, a technology which permits new and unique contributions to the coastal zone is needed. (See also W72-10575) (Strachan-Chicago)
W72-10583

MARINE WASTE DISPOSAL SYSTEMS: ALTERNATIVES AND CONSEQUENCES, California Univ., Berkeley. E. A. Pearson.

In: Coastal Zone Management: Multiple Use With Conservation, University of California Engineering and Physical Sciences Extension Series, John Wiley and Sons, Inc., New York, N.Y. 1972. p 286-295. 2 fig, 2 tab, 4 ref.

Descriptors: *Estuaries, *Coasts, *Waste treatment, Environment, Quality control, Design criteria, Waste disposal.

Identifiers: *Marine waste disposal systems, *Estuary-coastal discharge, *Open coast disposal, Coastal zone management.

The estuary-coastal discharge dilemma and the open coast disposal problem are discussed. The public's increasing concern regarding environmental quality is coupled with a limited factual knowledge about waste discharge effects and the objectives or performance of conventional waste treatment systems. There is general belief that all waste treatment systems accomplish the same objectives, that all waste treatment is uniformly good, and that the higher the degree of treatment in any given situation, the better the results. Such generalizations lead to designs that are conceptually inappropriate and which might result in dangerous consequences. There has been increasing public pressure to upgrade waste treatment (i.e., to convert primary plants to secondary treatment) without similar support for the construction of larger dilution-dispersal systems to gain the benefit of reduced waste concentrations by dilution and decay. It is highly questionable if a policy requiring secondary waste treatment for all waste discharges makes any real sense, since the policy will probably encourage the discharging of wastes into the estuary at the point of generation. (See also W72-10575) (Strachan-Chicago)
W72-10584

OCEANIC OVERWASH AND ITS ECOLOGICAL IMPLICATIONS ON THE OUTER BANKS OF NORTH CAROLINA, National Park Service, Washington, D.C. Office of Natural Science Studies.

For primary bibliographic entry see Field 02L.
W72-10632

ECOLOGIC IMPACTS OF WADING BIRDS ON THE AQUATIC ENVIRONMENT, Auburn Univ., Ala. Water Resources Research Inst.

J. L. Dusi, R. T. Dusi, D. L. Bateman, C. A. McDonald, and J. J. Stuart.
Available from the National Technical Information Service as PB-210 746, \$3.00 in paper copy, \$0.95 in microfiche. Alabama Water Resources Research Institute, Auburn, WRRI Bulletin 5, June 1971. 117 p, 29 fig, 20 tab, 13 ref, append. OWRR A-010-ALA (3).

Descriptors: *Wading birds, *Aquatic environment, *Animal behavior, *Animal populations, *Food habits, *Aesthetics, Water birds, Wildlife, Ecological distribution.

Identifiers: *Ecologic impact, Excrement, Recreation values.

Aspects of wading bird ecology and behavior were studied for their direct and indirect impact on the aquatic environment. Population density, distribution and movement-behavior were determined through aerial transect studies, counts at nesting colonies and by radio-tagging and tracking individual birds. The needs of wading birds for specific types of water areas, most of which are not in conflict with the needs of man are described. Food habits and droppings, are closely related to the increased levels of nitrogen and phosphorus in the waters of the colonies and the resultant eutrophication produces large amounts of algal mat and duckweed. The droppings kill vegetation that they fall on. Aesthetic values are apparently of high importance to most bird club members, to farmers with or without heron colonies on their property and to most people associated with the tourist trade and businesses in areas where wading-birds might be present. These birds are a disadvantage to fish hatcheries and the colonies are not desirable when located close to homes.
W72-10806

THE NEED FOR ADVANCE PLANNING OF THERMAL DISCHARGES BEFORE SITE ACQUISITION, Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs. For primary bibliographic entry see Field 05G. W72-10825

A METHODOLOGY STUDY TO DEVELOP EVALUATION CRITERIA FOR WILD AND SCENIC RIVERS, REPORT OF FOREST SUB-PROJECT, Idaho Univ., Moscow. Water Resources Research Inst. For primary bibliographic entry see Field 04A. W72-10897

07. RESOURCES DATA

7A. Network Design

THE DEVELOPMENT OF A PROCEDURE FOR ACQUIRING AND DISSEMINATING INFORMATION ON WATER USE, VOLUMES, 1 AND 2, Enviro Control, Inc., Washington, D.C.

Contract Report to the U.S. Geological Survey, March 1972. 257 p, 8 fig, 14 tab, 3 append. Contract USGS 14-08-0001-12743.

Descriptors: *Data collections, *Water utilization, *Water users, *Water demand, *Data storage and retrieval, Basic data collections, Networks, Statistics, Documentation.
Identifiers: *Water use data.

Quantitative understanding of water use is an essential component of planning, managing and operating the Nation's water resources. Unfortunately the data on water use available today are in many cases not very reliable and in most cases extremely hard to obtain. More than a dozen Federal agencies and at least three in each State collect small specialized parts of the data. State water use data collection and dissemination efforts vary widely from excellent continuing programs to weak sporadic surveys. Federal sources of data vary equally widely. Fundamental data improvement efforts (normally involving field measurement) are urgently needed in irrigation water use, thermoelectric evaporative consumption, water-related recreational use and almost all areas of change in water quality due to use (particularly nonpoint sources of pollution loads). A National Water Use Data System is recommended. Accom-

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panying a basic concept of the structure of a National Water Use Data System (NWUDS) are estimates of schedule, manpower and funding. In addition, proposed model data forms, model processing program flow charts, and basic data improvement program outlines are presented. Detailed summaries of users of data, State and regional data sources, and Federal data sources are included. A series of recommendations are made for improvement of current data collection efforts through minor modifications. (Knapp-USGS) W72-10467

INFORMATION SYSTEMS AND DATA REQUIREMENTS: COASTAL DEVELOPMENT PLANNING,
Naval Postgraduate School, Monterey, Calif.
For primary bibliographic entry see Field 06G.
W72-10582

QUANTITATIVE ANALYSIS OF DRAINAGE NETWORKS,
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
For primary bibliographic entry see Field 02E.
W72-10705

COASTAL ZONE BASELINES AND MONITORING FOR POLLUTION AND ENVIRONMENTAL QUALITY.
National Academy of Sciences-National Research Council, Washington, D.C.
For primary bibliographic entry see Field 05A.
W72-10901

METRICATION IN HYDROLOGY,
Ministry of Works, Wellington (New Zealand).
A. C. Hopkins.
New Zealand Ministry of Works Handbook of Hydrological Procedures, Procedure No 45, 1971. 15 p.

Descriptors: Publications, *Hydrology, *Measurement, International commissions, Dimensions.
Identifiers: *Metric system, *New Zealand, Conversion tables, British units, Handbook.

Over the next few years New Zealand will begin conversion to the metric system. While there are several forms of the metric system, the one to be adopted is the 'Système Internationale d'Unités', with the abbreviation 'SI' in all languages. Details of this system, as pertaining to hydrology, are presented. (Woodard-USGS)
W72-11085

7B. Data Acquisition

SIGNIFICANT ACCOMPLISHMENTS IN SCIENCES -- GODDARD SPACE FLIGHT CENTER, 1970.
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.

Available from the National Technical Information Service, Springfield, Va 22151 as NASA SP-286, \$3.00 in paper copy, \$0.95 in microfiche. Proceedings of Symposium, NASA Goddard Space Flight Center, Jan 14, 1971: National Aeronautics and Space Admin Special Publication NASA SP-286, 1972. 247 p.

Descriptors: *Remote sensing, *Satellites (Artificial), *Aerial photography, *Data collections, *Hydrologic data, Climatic data, Meteorological data, Infrared radiation, Microwaves, Water temperature, Oceans, Upwelling, Clouds, Winds, Rivers, Geology.
Identifiers: *NASA.

This report includes 46 papers that were presented at the symposium held at Goddard Space Flight Center, Greenbelt, Maryland on January 14, 1971.

Emphasis is on collection of meteorological, climatic and hydrologic data from manmade satellites equipped with infrared and microwave instruments. (See W72-10451 thru W72-10456) (Woodard-USGS) W72-10450

GEOLOGICAL FEATURES IN WYOMING FROM NIMBUS 1,

National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center. N. Short.

In: Significant Accomplishments in Sciences, Goddard Space Flight Center, 1970; Proc of Symposium, held at NASA, Greenbelt, Md, Jan 14, 1971: Nat'l Aeronautics and Space Admin Special Publication NASA SP-286, p 14-17, 1972. 2 fig.

Descriptors: *Remote sensing, *Aerial photography, *Satellites (Artificial), *Infrared radiation, *Water resources development, Surface waters, Topography, Geology, Vegetation, Photogrammetry, Photography, Maps, Wyoming, Colorado, Utah, Idaho.
Identifiers: Nimbus 1, NASA.

A Nimbus 1 (satellite) photo, covering about 500 kilometers, shows the southwestern third of Wyoming, the northwestern part of Colorado, the northeastern part of Utah, and a small part of Idaho. Major features include the Uinta and the Wasatch Mountains, the Green River, Wind River, and Uinta basins, and the headwaters of the Wind River and the Green River. A topographic map of the same area clearly shows a relation between topographic highs, or uplands, and darker areas on the photos. The correspondence between geology, topography, and vegetation is again evident when the Nimbus photo is compared with a geological map of the region. (See W72-10450) (Woodard-USGS)
W72-10451

HYDROLOGY OF THE NIGER RIVER FROM NIMBUS HRIR,

National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center. P. Gloersen.

In: Significant Accomplishments in Sciences, Goddard Space Flight Center, 1970; Proc of Symposium, held at NASA, Greenbelt, Md, Jan 14, 1971: Nat'l Aeronautics and Space Admin Special Publication NASA SP-286, p 18-21, 1972. 2 fig.

Descriptors: *Remote sensing, *Satellites (Artificial), *Infrared radiation, *Water resources development, *Africa, Surface waters, Groundwater, Photogrammetry, Photography, Evaluation, Hydrology, Aerial photography.
Identifiers: *Niger River, Republic of Mali, West Africa, NASA, Nimbus 3.

The seasonal changes of the Niger River in the Republic of Mali, West Africa, are described by daytime imagery obtained with the high-resolution infrared radiometer on Nimbus 3. This imagery is produced by reflection of solar radiation in the spectral region from 0.7 to 1.3 micrometers, principally at 1 micrometer. As water absorbs most of the radiation at 1 micrometer, the oceans, lakes, and rivers appear dark. Clouds reflect most of the radiation and are bright; quartz sands, such as those in the Sahara Desert, are almost as bright as clouds. The southern coast of West Africa has rain 12 months of the year. The change in the Niger basin from May to July is due to the accumulation of runoff in a huge area of Mali known as the Inland Delta. The open-water surface of this region is approximately 16,000 sq miles at maximum flood stage. At Segou, an older channel of the Niger appears darker because of the subsurface flow of water. This channel may prove useful for irrigation purposes in the future. (See W72-10450) (Woodard-USGS)
W72-10452

NIMBUS OBSERVATION OF OCEANIC UPWELLING,

National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center. K. H. Szekielda.

In: Significant Accomplishments in Sciences, Goddard Space Flight Center, 1970; Proc of Symposium, held at NASA, Greenbelt, Md, Jan 14, 1971: Nat'l Aeronautics and Space Admin Special Publication NASA SP-286, p 14-17, 1972. 2 fig.

Descriptors: *Remote sensing, *Aerial photography, *Satellites (Artificial), *Infrared radiation, *Oceans, Water temperature, Upwelling, Nutrients, Phosphates, Winds, Photogrammetry, Photography, Maps.
Identifiers: Nimbus 2, NASA.

One of the largest regions of upwelling appears along the northeast coast of Africa during the southwest monsoon. By measuring the emission of the ocean's surface with infrared radiometers on Nimbus satellites, the development of cold-water areas has been followed over relatively long periods. The typical temperature distribution, as obtained with the high-resolution infrared radiometer aboard the Nimbus 2 satellite during July 1966, is shown along the northeast coast of Africa. Isolines were drawn at temperatures in the water of 27.15K (1 deg Celsius). The transfer of cold water from the deeper layers of the oceans brings nutrients to the surface water. Because plankton and also fishes graze on the stock of organic matter, the areas of upwelling have a very high potential for the fishing industry. Measurements of the dissolved phosphate in the surface water along the Somali coast show that the phosphate concentration in the core of upwelling was about ten times that of the open ocean. (See W72-10450) (Woodard-USGS)
W72-10453

MICROWAVE EMISSION OF ARCTIC SEA ICE,

National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center. P. Gloersen.

In: Significant Accomplishments in Sciences, Goddard Space Flight Center, 1970; Proc of Symposium, held at NASA, Greenbelt, Md, Jan 14, 1971: Nat'l Aeronautics and Space Admin Special Publication NASA SP-286, p 18-21, 1972. 2 fig.

Descriptors: *Remote sensing, *Aircraft, *Arctic Ocean, *Sea ice, Infrared radiation, Microwaves, Water temperature, Photogrammetry, Photography.
Identifiers: NASA.

Aircraft flights were conducted to demonstrate the feasibility of microwave radiometers to be carried on the Nimbus E and F missions. The passive microwave signatures of Arctic Sea ice related very specifically to the structure and type of ice. Two main categories of ice could be distinguished: radiometrically hot and cold, corresponding to gray and white ice respectively as observed visually and photographically. Glaciologists have determined that the cold or white ice is relatively undisturbed Arctic Sea ice, while the warm or gray ice is heavily hummocked, having undergone considerable dynamic activity. Some examples of the radiometric signatures of the two kinds of ice are shown. The aircraft altitude was 150 meters over the Arctic Sea ice at a location north of Point Barrow, Alaska. The prominent dark streaks in the picture result from the polynas, or open water in the cracks of the sea ice. The observed microwave brightness temperature difference between open water and ice ranges from 100 to 105K. (See W72-10450) (Woodard-USGS)
W72-10454

MICROWAVE MEASUREMENTS OF SEA STATE,

National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center. T. Wilheit.

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In: Significant Accomplishments in Sciences, Goddard Space Flight Center, 1970. Proc of Symposium, held at NASA, Greenbelt, Md, Jan 14, 1971; Nat'l Aeronautics and Space Admin Special Publication NASA SP-286, p 22-27, 1972. 3 fig.

Descriptors: *Remote sensing, *Radio waves, *Microwaves, *Oceans, *Meteorology, Water temperature, Winds, Data collections, Aircraft, Aerial photography, Correlation analysis, Analytical techniques, Air-water interfaces.
Identifiers: Sea surface, Radiometer, Sea foam, Sea roughness.

The determination of sea roughness is of interest to meteorologists because of its relationship to surface winds and the flux of energy and momentum at the ocean-atmosphere interface. Microwave measurements offer great promise toward making such determinations by aircraft. At microwave frequencies, the magnitude of the complex index of refraction of sea water is large, as much as 10. This causes the ocean surface to be quite reflective. The brightness temperature of the ocean is on the order of 100 to 150 kelvins, much colder than its physical temperature. However, if the surface is roughened by wind, the reflectivity is reduced and the surface appears warmer. The generally cited and widely accepted theory for this fact treats only the large-scale irregularities through geometric optics. It predicts little increase in brightness unless the surface is viewed at inconveniently oblique angles. This theory is contradicted by data from the 1.55-centimeter radiometer on board the NASA Convair 990 airborne observatory taken over the Salton Sea, the North Atlantic, and the North Sea. For winds greater than about 10 meters per second, there is a significant increase in brightness temperature; it appears that this is due to foam coverage. (See W72-10450) (Woodard-USGS)
W72-10455

AIR-SEA INTERACTION IN THE PACIFIC OCEAN,

National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center. L. Allison.

In: Significant Accomplishments in Sciences, Goddard Space Flight Center, 1970; Proc of Symposium, held at NASA, Greenbelt, Md, Jan 14, 1971; Nat'l Aeronautics and Space Admin Special Publication NASA SP-286, p 28-31, 1972. 2 fig.

Descriptors: *Remote sensing, *Aerial photography, *Satellites (Artificial), *Pacific Ocean, *Air-water interfaces, Meteorology, Clouds, Water temperature, Photography, Data collection, Correlation analysis, Meteorological data, Computer programs, Water circulation, Cloud cover.
Identifiers: *Satellites (TIROS and ESSA).

Cloud charts were produced from daily TIROS and ESSA satellite television nephanelyses over the Pacific Ocean for a study of the interaction of tropical oceans with the atmosphere. Figures show the variation of the monthly cloudiness over the Intertropical Zone of Convergence (IZC) in the eastern tropical Pacific from August 1962 to October 1970. A histogram shows the seasonal variation in this same area covered by a positive sea-surface temperature anomaly. A -0.70 correlation coefficient and a + 9-month lag were determined by comparing these data, using statistical computer techniques. Cold water entered this latitude band after 9 months following the advent of heavy tropical cloudiness. This relationship indicates the feedback loop from a localized 'Hadley circulation' in the eastern tropical Pacific Ocean. (See W72-10450) (Woodard-USGS)
W72-10456

REMOTE MEASUREMENT OF POLLUTION.

National Aeronautics and Space Administration, Washington, D.C.
For primary bibliographic entry see Field 05B.
W72-10468

ROLE OF REMOTE SENSING IN DEVELOPING COUNTRIES.

Agency for International Development, Washington, D.C. Office of Science and Technology.

Available from NTIS, Springfield, Va. 22151 as PB-203 309, \$3.00 in paper copy; \$0.95 in microfiche. Report TA/OAST 71-3, July 1971. 96 p, 3 tab, 6 ref, append. (Paper presented at 7th Int. Symp. on Remote Sensing of the Environment, May 18, 1971, Ann Arbor, Mich.).

Descriptors: *Remote sensing, *Water resources development, *Aerial photography, *Aircraft, Foreign countries, Geology, Engineering structures, Dams, Damsites, Water supply, Irrigation systems, Satellites (Artificial), Data collections, Planning, Soil surveys, Mineralogy, Economic efficiency, Mapping.
Identifiers: Developing countries.

This report includes three papers, an appendix, and a bibliography concerning remote sensing endeavors which will benefit developing countries. Adequate data relevant to new engineering projects including dams, roads, and irrigation systems are discussed. For example, in the Dominican Republic aerial photography played an important role in an integrated resource survey that served as the basis for preinvestment and feasibility studies of (a) development of the Yuna River Delta, (b) modernization of farming practices in the Azua Plain, (c) drainage of the Atlantic Coastal Plain, (d) citrus fruit production, and (e) several irrigation projects. Satellite imagery will be useful as an educational tool for students of geology, oceanography, hydrology, and other disciplines. Judging from Apollo photography, this type of imagery should be of interest to topographic mapping agencies in some countries where improved base maps are needed. (Woodard-USGS)
W72-10631

THE USE OF A THERMAL LINE SCANNER IN THE REMOTE SENSING OF WATER POLLUTION,

Wisconsin Univ., Madison. Remote Sensing Group; and Wisconsin Univ., Madison. Marine Studies Center.

For primary bibliographic entry see Field 05B.
W72-10644

STUDIES IN REMOTE SENSING OF SOUTHERN CALIFORNIA AND RELATED ENVIRONMENTS,

California Univ., Riverside. Dept. of Geography.

For primary bibliographic entry see Field 07C.
W72-10646

FUNDAMENTALS OF SOIL MOISTURE. VOLUME II: INVESTIGATION TECHNIQUES OF SOIL WATER REGIME (OSNOVY UCHENIYA O POCHVENNOY VLAGE. TOM II: METODY IZUCHENIYA VODNOGO REZHIMA PODCHV),

For primary bibliographic entry see Field 02G.
W72-10663

234U/238U AS A TOOL FOR DATING MARINE SEDIMENTS,

Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.

For primary bibliographic entry see Field 02J.
W72-10675

SENSITIVITY PROBLEMS IN BIOLOGICAL AND ENVIRONMENTAL COUNTING,

California Univ., Livermore. Lawrence Radiation Lab.

For primary bibliographic entry see Field 05A.
W72-10688

KEY TO FIELD IDENTIFICATION OF ANADROMOUS JUVENILE SALMONIDS IN

THE PACIFIC NORTHWEST, 10R. J. MCCONNEL, AND

National Marine Fisheries Service, Seattle, Wash. R. J. McConnell, and G. R. Snyder.

Available from Superintendent of Documents, Price \$0.20, Stock number 0320-0021. National Oceanic and Atmospheric Administration Technical Report NMFS CIRC-366, January 1972, 6 p, 3 fig, 15 ref.

Descriptors: *Juvenile fish, *Salmonids, *Pacific Northwest U.S., On-site investigations, Speciation, Freshwater fish, Rivers.

This key lists and illustrates the external characteristics which will expedite field identification of juvenile salmonids in the Pacific Northwest. Five species of Pacific salmon (pink, chum, sockeye, chinook, and coho); four species of trout (cutthroat, brown, Dolly Varden, and rainbow or steelhead); and other juvenile and adult fish that may be mistaken for salmon or trout in fresh water are described. (Bopp-ORNL)
W72-10690

SYSTEMATIC AND RANDOM ERRORS IN DUAL GAMMA ENERGY SOIL BULK DENSITY AND WATER CONTENT MEASUREMENTS,

Washington State Univ., Pullman. Dept. of Soil Science.

For primary bibliographic entry see Field 02G.
W72-10716

APPROXIMATION OF FIELD HYDRAULIC CONDUCTIVITY BY LABORATORY PROCEDURES ON INTACT CORES,

California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.

For primary bibliographic entry see Field 02G.
W72-10717

ENERGY AND MASS TRANSFER THROUGH AN AIR-WATER INTERFACE,

Stanford Univ., Calif. Dept. of Civil Engineering.

For primary bibliographic entry see Field 02A.
W72-10730

TREE RINGS, STREAM RUNOFF, AND PRECIPITATION IN CENTRAL NEW YORK--A REEVALUATION,

Geological Survey, Arlington, Va.

For primary bibliographic entry see Field 02A.
W72-10740

APPARATUS FOR A DEPTH INDICATOR,

A. Rubin.

U. S. Patent No. 3,528,053, 3 p, 1 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 878, No. 2, p. 503, September 8, 1970.

Descriptors: *Patents, *Water level recorders, *Water level fluctuations, *Depth, Instrumentation, Measurement, Water levels.
Identifiers: *Digital depth indicators.

An electronic digital depth indicator provides a visible, digital display of the water depth as well as a minimum water depth alarm signal. It has a transducer for periodically transmitting sonar type pulses and for receiving echo pulses. There is a device for periodically gating the pulses only during an interval between a transmitted sonar pulse and an associated echo pulse. (Sinha-OEIS)
W72-10773

AIRBORNE SCANNER TRACES THERMAL POLLUTION,

Abrams Aerial Survey Corp., Lansing, Mich.

For primary bibliographic entry see Field 05B.
W72-10820

RESOURCES DATA—Field 07

Evaluation, Processing and Publication—Group 7C

SUBMARINE SPRING EXPLORATIONS: NORTHWEST COAST OF PUERTO RICO,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.

D. J. Percios.

Available from the National Technical Information Service as PB-210 754, \$3.00 in paper copy, \$0.95 in microfiche. Puerto Rico Water Resources Research Institute Final Report, November 1971. 48 p, 30 fig, 1 tab, 26 ref. OWRR A-029-PR (1).

Descriptors: *Remote sensing, *Aerial photography, *Subsurface runoff, *Oceans, *Puerto Rico, Groundwater movement, Coasts, Springs, Estuaries, Photography, Infrared radiation, Data collections, Aircraft, Analytical techniques, Water pollution sources, Sediment transport, Geology.

In an attempt to delineate areas of ocean groundwater discharge along the northwestern coastal area of Puerto Rico, a series of aerial photographic missions and near-coastal conductivity traverses were made. It was also an objective of the photographic missions to establish that the use of small format (35 mm) photography, utilizing Ektachrome Infrared and Ektachrome X film, is a fruitful approach to water resources investigations for small agencies. Three spring areas were found using a trailing specific conductivity probe from the Institute's 34 foot research vessel. The aerial photos did not positively indicate the presence of spring areas; however, large blurry areas could be seen indicating that the differences between sea water and inflowing groundwater may be detected. The films demonstrated their effectiveness in such water resources areas as (1) pinpointing pollution sources and defining their areal extent; (2) the potential of quantitative determination of sediment transport; (3) location of seepage areas; (4) the action of waves along the beaches; and (5) the sharp determination of near coastal ocean bottom topography and geologic structures. (Woodard-USGS)
W72-10896

RADIATION MEASUREMENT,
Atmospheric Environment Service, Ottawa (Ontario).
For primary bibliographic entry see Field 05A.
W72-10945

AN EVALUATION OF CHEMICAL GAUGING TECHNIQUES,
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 02E.
W72-11068

7C. Evaluation, Processing and Publication

APPLICATION OF NONPARAMETRIC STATISTICAL TESTS IN HYDROLOGY,
Pennsylvania State Univ., University Park. Mineral Conservation Section.
For primary bibliographic entry see Field 02F.
W72-10439

STOCHASTIC HYDRAULICS.
For primary bibliographic entry see Field 08B.
W72-10457

A METHOD FOR FLOW COMPUTATION IN FLOOD PLAIN CHANNELS,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 08B.
W72-10459

EFFECTIVE USE OF STOCHASTIC INFORMATION WITH DETAILED ANALYTIC MODELS,
Texas Water Development Board, Austin. Systems Engineering Div.

For primary bibliographic entry see Field 08B.
W72-10465

THE DEVELOPMENT OF A PROCEDURE FOR ACQUIRING AND DISSEMINATING INFORMATION ON WATER USE, VOLUMES 1 AND 2.

Enviro Control, Inc., Washington, D.C.
For primary bibliographic entry see Field 07A.
W72-10467

PRECIPITATION MEASUREMENT IN NEW ZEALAND REPRESENTATIVE AND EXPERIMENTAL BASINS,
Ministry of Works, Wellington (New Zealand). Water and Soil Div.

For primary bibliographic entry see Field 02B.
W72-10474

COMPUTER MODEL OF CROSSFLOW TOWERS,
Union Carbide Corp., Oak Ridge, Tenn.
For primary bibliographic entry see Field 05G.
W72-10559

THE RIVER BASIN MODEL: COMPUTER OUTPUT.

Envirometrics, Inc., Washington, D.C.
For primary bibliographic entry see Field 06A.
W72-10574

WATER RESOURCES INVESTIGATIONS IN NEW MEXICO, 1969.
Geological Survey, Washington, D.C.

Available free on request to USGS, Washington, DC 20242. Geological Survey Report of Investigations Folder, 1 sheet, 1969. 7 fig, 1 map.

Descriptors: *Water resources, *Investigations, *New Mexico, *Inter-agency cooperation, Precipitation (Atmospheric), Runoff, Surveys, Planning, Hydrologic data, Basic data collections, Streamflow, Sediment transport, On-site investigations, Water quality, Water temperatures, Water level fluctuations, Bibliographies, Networks, Maps.
Identifiers: *Cooperative water-studies program, Research projects.

The water resources studies and investigations of the U. S. Geological Survey in New Mexico are summarized. A selected bibliography of material concerning the State is included. A list is given of State and Federal agencies, counties, and cities who cooperate in different parts of the program. The hydrologic data network consists of 215 primary, secondary, and water management streamflow stations; 1,639 groundwater observation wells; and 61 water quality observing sites. Small State maps show principal sources of groundwater, mean annual precipitation, mean annual runoff, suspended-sediment concentrations, discharge of the principal rivers, and water quality of ground and surface waters. A map, scale 50 mi to the inch, shows by symbols, numbers, and colored outline the hydrologic data network and investigations in New Mexico in January 1969. (Woodard-USGS)
W72-10633

WATER RESOURCES INVESTIGATIONS IN RHODE ISLAND, 1968.
Geological Survey, Washington, D.C.

Available free on request to USGS, Washington, DC 20242. Geological Survey Report of Investigations Folder, 1 sheet, 1968. 3 fig, 1 map.

Descriptors: *Water resources, *Investigations, *Rhode Island, *Inter-agency cooperation, Surveys, Planning, Hydrologic data, Basic data collections, Precipitation (Atmospheric), Streamflow, Runoff, Water temperatures, On-site in-

vestigations, Water quality, Water level fluctuations, Bibliographies, Networks, Maps.
Identifiers: *Cooperative water-studies program, Research projects.

The water resources studies and investigations of the U.S. Geological Survey in Rhode Island are summarized. Selected bibliography of material concerning the State is included. A list is given of State and Federal agencies, counties, cities who cooperate in different parts of the program. The hydrologic data network consists of 21 primary, secondary, and water management streamflow stations; 49 groundwater observation wells; and 3 water quality observing sites. Small State maps show principal sources of groundwater, mean annual precipitation, average annual runoff, and average discharge of the principal rivers. A map, scale approximately 10 mi to the inch, shows by symbols, numbers, and colored outline the hydrologic data network and investigations in Rhode Island in December 1968. (Woodard-USGS)
W72-10634

WATER RESOURCES AT MARINE CORPS SUPPLY CENTER, BARSTOW, CALIFORNIA FOR THE 1971 FISCAL YEAR,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 04B.
W72-10645

STUDIES IN REMOTE SENSING OF SOUTHERN CALIFORNIA AND RELATED ENVIRONMENTS,
California Univ., Riverside. Dept. of Geography.
L. W. Bowden.

Available from NTIS Springfield, Va. 22151. PB-204 741 - Price \$3.00 in paper copy, \$0.95 in microfiche. US Geological Survey-National Aeronautics and Space Administration Interagency Report USGS-222, August 1971. 19 p, 9 ref. Contract No USGS 14-08-0001-10674. NASA W-12570.

Descriptors: *Remote sensing, *Aerial photography, *Environmental gradient, *Geophysics, *California, Methodology, Instrumentation, Aircraft, Cameras, Infrared radiation, Measurement, Spectroscopy, Data collections, Soil moisture, Temperature, Land use, Mapping, Meteorological data, Microwaves.
Identifiers: *Cooperative water-studies program, Research projects.

During the spring of 1968, the USGS/NASA Remote Sensing Mission 73 was conducted in southern California. This report is concerned with the geographic applications sites in Los Angeles, the Coachella Valley, and the Imperial Valley. Remote sensing data were acquired by thirteen sensors mounted in seven aircraft. Ground truth activities conducted before, during, and after the flights resulted in the acquisition of the following data: (1) soil moisture samples; (2) thermometric and radiometric surface temperatures at several frequencies; (3) surface reflectance measurements; (4) land use maps; (5) U.S. Geological Survey and U.S. Weather Bureau hourly weather readings; (6) hourly readings of atmospheric SO₂ and NO₂; (7) multi-spectral ground photography; (8) urban data; (9) calibrated test target readings; (10) atmospheric particle counts; (11) soil bearing strength measurements; and (12) soil electrical resistivity measurements. Infrared Aero Ektachrome film, used with 15+80B or 15+82B filters, was the single most effective sensor for land use determination. The passive microwave scanning radiometer can detect wind disturbance, hence horizontal energy transfer, over large bodies of water. The scanning microwave radiometer shows potential for soil moisture determination. (Woodard-USGS)
W72-10646

WATER WELL AND GROUND-WATER CHEMICAL ANALYSIS DATA, REAGAN COUNTY, TEXAS,
Texas Water Development Board, Austin.

Field 07—RESOURCES DATA

Group 7C—Evaluation, Processing and Publication

For primary bibliographic entry see Field 04B.
W72-10649

WATER WELL AND GROUND-WATER CHEMICAL ANALYSIS DATA, IRION COUNTY, TEXAS,
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 04B.
W72-10650

MOUTERE, IHD EXPERIMENTAL BASIN NO. 8, 1970.
For primary bibliographic entry see Field 04C.
W72-10653

PURUKOHUKOHU, IHD EXPERIMENTAL BASINS NOS 4 AND 5, TO 1969.
For primary bibliographic entry see Field 04A.
W72-10654

WATER RESOURCES INVESTIGATIONS IN TEXAS, 1969.
Geological Survey, Washington, D.C.

Available free on request to USGS, Washington, D.C., 20242. Geological Survey Report of Investigations Folder, 1 sheet, 1969. 4 fig, 1 map.

Descriptors: *Water resources, *Investigations, *Texas, *Inter-agency cooperation, Surveys, Planning, Hydrologic data, Basic data collections, Precipitation (Atmospheric), Streamflow, Sediment transport, On-site investigations, Water temperature, Water quality, Dissolved solids, Water level fluctuations, Bibliographies, Networks, Maps.
Identifiers: *Cooperative water-studies program, Research projects.

The water resources studies and investigations of the U. S. Geological Survey in Texas are summarized. A selected bibliography of material concerning the State is included. A list is given of State and Federal agencies, counties, and cities who cooperate in different parts of the program. The hydrologic data network consists of 529 primary, secondary, and water management streamflow stations; 299 groundwater observation wells; and 225 water quality observing sites. Small State maps show principal sources of groundwater, normal annual precipitation, discharge of the principal rivers, and the dissolved solids in streams. A map, scale 50 mi to the inch, shows by symbols, numbers, and colored outline the hydrologic data network and investigations in Texas in 1969. (Woodard-USGS)
W72-10726

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR ELM FORK TRINITY RIVER, TRINITY RIVER BASIN, TEXAS, 1970.
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02E.
W72-10728

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR DEEP CREEK, COLORADO RIVER BASIN, TEXAS, 1970.
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02E.
W72-10729

RESEARCH ON DRY-TYPE COOLING TOWERS FOR THERMAL ELECTRIC GENERATION: PART II,
Beck (R. W.) and Associates, Denver, Colo.
For primary bibliographic entry see Field 05D.
W72-10810

NORTH ATLANTIC REGIONAL SUPPLY MODEL,
Meta Systems, Inc., Cambridge, Mass.

For primary bibliographic entry see Field 06A.
W72-10886

SOME RECOMMENDATIONS FOR THE OPERATION OF REPRESENTATIVE AND EXPERIMENTAL BASINS AND THE ANALYSIS OF DATA.
For primary bibliographic entry see Field 02A.
W72-10902

USE OF SUBJECTIVE INFORMATION IN ESTIMATION OF AQUIFER PARAMETERS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources; and Arizona Univ., Tucson. Dept. of Systems Engineering.
For primary bibliographic entry see Field 02F.
W72-10906

CHEMICAL, BIOLOGICAL, AND PHYSICAL DATA FOR THE MAJOR LAKES AND RESERVOIRS IN LOUISIANA,
Geological Survey, Baton Rouge, La.
For primary bibliographic entry see Field 02H.
W72-10915

WATER RESOURCES INVESTIGATIONS IN WEST VIRGINIA, 1968.
Geological Survey, Washington, D.C.

Available free upon request from USGS, Washington, D C 20242. Geological Survey Report of Investigation Folder, 1 sheet, 1969. 4 fig, 1 map.

Descriptors: *Water resources, *Investigations, *West Virginia, *Inter-agency cooperation, Surveys, Planning, Hydrologic data, Basic data collections, Streamflow, Precipitation (Atmospheric), On-site investigations, Water temperature, Water quality, Sediment transport, Water level fluctuations, Bibliographies, Networks, Maps.
Identifiers: *Cooperative water-studies program, Research projects.

Water resources studies and investigations of the U. S. Geological Survey in West Virginia are summarized. A selected bibliography of material concerning the State is included. A list is given of State and Federal agencies, counties, and cities who cooperate in different parts of the program. The hydrologic data network consists of 112 primary, secondary, and water management streamflow stations; 23 groundwater observation wells; and 27 water quality observing sites. Small State maps show principal sources of groundwater, discharge of the principal rivers, and mean annual precipitation. A map, scale 42 mi to the inch, shows by symbols, numbers, and colored outline the hydrologic data network and investigations in West Virginia in October 1968. (Woodard-USGS)
W72-10918

WATER RESOURCES INVESTIGATIONS IN WASHINGTON, 1968.
Geological Survey, Washington, D.C.

Available free upon request from USGS, Washington, D C 20242. Geological Survey Report of Investigations Folder, 1 sheet, 1968. 10 fig, 1 map.

Descriptors: *Water resources, *Investigations, *Washington, *Inter-agency cooperation, Surveys, Planning, Hydrologic data, Basic data collections, Precipitation (Atmospheric), Runoff, Streamflow, Sediment transport, On-site investigations, Water temperature, Water quality, Dissolved solids, Water level fluctuations, Bibliographies, Networks, Maps.
Identifiers: *Cooperative water-studies program, Research projects.

Water resources studies and investigations of the U. S. Geological Survey in Washington are summarized. A selected bibliography of material concerning the State is included. A list is given of

State and Federal agencies, counties, and cities who cooperate in different parts of the program. The hydrologic data network consists of 410 primary, secondary, and water management streamflow stations; 221 groundwater observation wells; and 120 water quality observing sites. Small State maps show principal sources of groundwater, average annual precipitation, average annual runoff, sediment concentrations transported by streams, discharge of the principal rivers, and the dissolved solids and hardness in ground and surface waters. A map, scale 32 mi to the inch, shows by symbols, numbers, and colored outline the hydrologic data network and investigations in Washington in August 1968. (Woodard-USGS)
W72-10919

WATER RESOURCES INVESTIGATIONS IN SOUTH DAKOTA, 1969.
Geological Survey, Washington, D.C.

Free on request to USGS, Washington, D C, 20242. Geological Survey Report of Investigations Folder, 1 sheet, 1969. 8 fig, 1 map.

Descriptors: *Water resources, *Investigations, *South Dakota, *Inter-agency cooperation, Surveys, Planning, Hydrologic data, Basic data collections, Precipitation (Atmospheric), Runoff, Streamflow, Sediment transport, On-site investigations, Water temperature, Water quality, Dissolved solids, Water level fluctuations, Bibliographies, Networks, Maps.
Identifiers: *Cooperative water-studies program, Research projects.

Water resources studies and investigations of the U. S. Geological Survey in South Dakota are summarized. A selected bibliography of material concerning the State is included. A list is given of State and Federal agencies, counties, and cities who cooperate in different parts of the program. The hydrologic data network consists of 113 primary, secondary, and water management streamflow stations; 229 groundwater observation wells; and 20 water quality observing sites. Small State maps show principal sources of groundwater, mean annual precipitation, mean annual runoff, discharge of the principal rivers, suspended sediment concentrations, predominant chemical constituents in major streams, and the dissolved solids in ground and surface waters. A map, scale 42 mi to the inch, shows by symbols, numbers, and colored outline the hydrologic data network and investigations in South Dakota in January 1969. (Woodard-USGS)
W72-11074

HYDROGEOLOGIC DATA FOR THE NORTHERN HIGH PLAINS OF COLORADO,
Geological Survey, Lakewood, Colo.
W. E. Hofstra, T. J. Major, and R. R. Luckey.
Colorado Water Conservation Board Basic-Data Release No 23, 1972. 143 p, 8 fig, 3 plate, 5 tab, 15 ref.

Descriptors: *Groundwater resources, *Hydrologic data, *Basic data collections, *Hydrogeology, *Colorado, Water wells, Aquifer characteristics, Water yield, Water supply, Water utilization, Water demand, Water quality, Specific conductivity, Nitrates, Well data, Water levels.
Identifiers: Northern High Plains (Colo).

Basic data on groundwater resources of the northern High Plains of Colorado include maps showing the locations of large-capacity (yield more than 100 gallons per minute) irrigation, public supply, and industrial wells, and the locations of selected water-level observation wells. Records of large-capacity wells drilled prior to October 1970, observation wells, water levels in wells, specific conductance, and nitrate content of waters from selected locations are tabulated. Information is based on data collected from 1968 to 1970 and on previous studies. Records of 2,416 irrigation wells, 62 public supply wells, and one in-

ENGINEERING WORKS—Field 08

Structures—Group 8A

dustrial well were obtained and all known large-capacity wells were inventoried. The use of groundwater for irrigation in the northern High Plains of Colorado increased from about 159,000 acre-feet in 1964 to about 429,000 acre-feet in 1971. The number of large-capacity wells increased from 700 to about 2,550 from 1964 to 1971 and water levels declined during this time as much as 16 feet in some areas. (Woodard-USGS)
W72-11080

GROUNDWATER IN POLK COUNTY, NEBRASKA,

Geological Survey, Washington, D.C.

C. F. Keech.

For sale by USGS, Washington, DC 20242, Price \$1.00. Geological Survey Hydrologic Investigations Atlas HA-389, 1 sheet, 1972. 6 fig, 2 map, 1 tab, 7 ref.

Descriptors: *Groundwater resources, *Water supply, *Water wells, *Irrigation water, *Nebraska, Hydrogeology, Aquifer characteristics, Withdrawal, Pumping, Water yield, Groundwater recharge, Water storage, Water utilization, Water quality, Chemical analysis.
Identifiers: *Polk County (Neb).

Graphs, maps, tables and a text describe the groundwater conditions and some of the effects of withdrawal of groundwater for irrigation in Polk County, Nebraska. The available groundwater in Polk County is stored in unconsolidated deposits that range in thickness from about 35 to a little more than 400 feet and rest on bedrock of Cretaceous age. The general configuration of the bedrock surface on which the water-bearing deposits rest is known from logs of 31 test holes drilled along three north-south lines, from logs of 10 irrigation wells and 2 test holes for irrigation wells, and from observations at 2 gravel pits. Well yields greater than 1,000 gpm can be obtained throughout all but about 30 square miles, or 7 percent, of the county area. Withdrawals for irrigation and public supply are slowly diminishing the quantity of water in storage beneath the upland area. Water in the Quaternary deposits is of the calcium bicarbonate type, and is suitable for irrigation and most industrial uses and for use by humans and livestock. (Woodard-USGS)
W72-11081

AVAILABILITY AND QUALITY OF GROUNDWATER IN THE ASHLAND QUADRANGLE, JACKSON COUNTY, OREGON,

Geological Survey, Washington, D.C.

J. H. Robison.

Available from USGS, Washington, DC 20242, Price \$1.00. Geological Survey Hydrologic Investigations Atlas HA-421, 1 sheet, 1972. 5 fig, 3 tab, 9 ref.

Descriptors: *Groundwater resources, *Water wells, *Water yield, *Water quality, *Oregon, Water supply, Water utilization, Withdrawal, Groundwater recharge, Precipitation (Atmospheric), Water analysis, Chemical analysis, Hydrologic data, Aquifer characteristics, Basic data collections.
Identifiers: *Jackson County (Oregon), *Ashland (Oreg).

This 1-sheet hydrologic atlas presents groundwater information that will enable water users, potential water users, and planners to estimate the likelihood of obtaining groundwater in adequate quantity and suitable quality in the Ashland quadrangle in the southwestern part of Oregon along the Oregon-California border. Trends of groundwater levels were estimated from records of an observation-well 8 miles northwest of Ashland. The well is completed in nonmarine sedimentary rocks and is pumped heavily. Its water level fluctuates 6 to 10 feet seasonally and has shown a slight overall decline since records began in 1960. Quantities of water obtainable from wells are generally adequate for household use but not

for irrigation or other large uses. In some areas the average expected yield from wells is 2 gpm or less, whereas in other areas the average yield is at least 15 gpm. The groundwater is generally of good chemical quality, although most is hard, and some contains excessive amounts of iron. (Woodard-USGS)
W72-11082

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR HONEY CREEK, TRINITY RIVER BASIN, TEXAS, 1970,

Geological Survey, Austin, Tex.

For primary bibliographic entry see Field 02E.
W72-11087

08. ENGINEERING WORKS

8A. Structures

OCEAN INSTALLATIONS: STATE OF TECHNOLOGY,

Naval Civil Engineering Lab., Port Hueneme, Calif.

For primary bibliographic entry see Field 06G.
W72-10583

SEA WATER INTRUSION EXTRACTION BARRIER,

California State Dept. of Water Resources, Los Angeles, Southern District.

J. J. Cope.

Preprint 1593, paper presented at ASCE National Water Resources Engineering Meeting, January 24-28, 1972, Atlanta, Ga: American Society of Civil Engineers, 1972. 27 p, 9 fig, 1 tab, 7 ref.

Descriptors: *Saline water intrusion, *Aquifers, *Water wells, *Saline water barriers, *California, Water supply, Hydraulic structures, Groundwater, Water level fluctuations, Drawdown, Hydraulic gradient, Sea water, Barriers, Engineering structures, Salinity.
Identifiers: *Ventura County (Calif), Extraction barrier.

In the Oxnard Plain of Ventura County, California, water producers have extracted increasingly larger volumes of water from the Oxnard aquifer, which underlies the area. As a consequence, groundwater levels declined to below sea level and sea water intruded into the aquifer. In 1965 a state legislative appropriation of \$310,000 was allocated to design and construct an experimental sea water intrusion barrier. Major facilities of the experimental extraction-type barrier were 5 extraction wells, 25 piezometers (at 18 drill sites), 1 anode well for cathodic protection, and a discharge pipeline. The combination of extractions at the experimental barrier and the rise in water levels elsewhere in the basin, except near the basin pumping trough, caused the diminution of the sea water intrusion area from the spring of 1967 to the spring of 1968. Sea water intrusion continued in the vicinity of the pumping trough because the capacity of the experimental barrier was not sufficient to create a seaward hydraulic gradient from it. However, an extraction-type barrier is technically feasible to protect the Oxnard aquifer in the vicinity of Port Hueneme from further sea water intrusion. (Woodard-USGS)
W72-10643

HORIZONTAL WATER WELLS (GORIZONTAL'NYYE VODOZABORNNYE SKVAZHINY),

P. A. Anatol'yevskiy, and G. A. Razumov.

'Nedra', Moscow, 1970. 200 p.

Descriptors: *Well data, *Water wells, *Hydraulic structures, Intakes, Pumps, Filters, Conduits, Shafts (Excavations), Tunnels, Aquifers, Groundwater, Drawdown, Specific capacity, Discharge (Water), Water supply, Drainage, Saturated soils,

Drilling equipment, Urban hydrology, Analog models.
Identifiers: *USSR, Well systems.

Engineering-hydrogeological conditions and areas of application of horizontal water wells, their design, economic advantages, and methods of construction in loose saturated soils are examined. Theory and construction of radial horizontal wells are illustrated by specific examples of their application for water supply and drainage in the Tatar, Bashkir, Georgian, Lithuanian, Ukrainian and other republics of the USSR and by development and testing in the United States, Germany, Hungary, Poland, etc. Effects of the basic parameters of horizontal wells on efficiency of operation are examined in analog-model investigations and in application of new design formulas to specific discharge of well systems under various hydrogeological conditions and infiltration regimes. (Josefson-USGS)
W72-10656

EVALUATION OF THREE ENERGY DISSIPATORS FOR STORM-DRAIN OUTLETS; HYDRAULIC LABORATORY INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

J. L. Grace, Jr., and G. A. Pickering.

Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Research Report H-71-1, April 1971. 14 p, 1 tab, 6 pl.

Descriptors: Settling basins, *Hydraulic models, *Energy dissipation, *Storm drains, *Outlets.
Identifiers: *Stilling wells, *Model tests.

Model tests of three commonly used energy dissipators for storm-drain outlets were conducted to determine the limiting discharges for various sizes of stilling wells, U. S. Bureau of Reclamation type VI basins, and St. Anthony Falls stilling basins. Charts were prepared for each type of energy dissipator, showing the maximum recommended discharge that will result in good performance for given outlet diameters and structure widths in terms of the outlet diameter. With these charts and other known parameters, the designer can select the type of dissipator best suited to protect the outlet. (WES)
W72-10666

OUTLET WORKS FOR BRANCHED OAK AND COTTONWOOD SPRINGS DAMS, OAK CREEK, NEBRASKA, AND COTTONWOOD SPRINGS CREEK, SOUTH DAKOTA: HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

J. L. Grace, Jr.

Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report H-72-1, January 1972. 30 p, 12 tab, 3 photo, 17 pl.

Descriptors: *Hydraulic models, *Open channel flow, *Outlet works, *Dam design, *Settling basins.

Identifiers: *Branched Oak Dam, *Cottonwood Springs Dam, *Exit channels.

Model investigations of outlet works for Branched Oak and Cottonwood Springs Dams concerned hydraulic operating characteristics over a wide range of heads. Geometric differences required use of separate model studies with 1:10-scale models reproducing portions of approach area, intake structure, and outlet conduit. The Branched Oak model also reproduced an SAT impact-type stilling basin and downstream exit channel. Both models indicated undesirable flow characteristics such as nappe flutter, sloshing, and gulping which tended to vibrate the structures. Tests indicated that flutter could be eliminated by rounding the weir crests; nappe sloshing could be eliminated by providing divider wall between and parallel to weir crests; and gulping beneath the cover plate

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eliminated by placing cover plate at an elevation above that of the upper pool when the conduit begins to control flow. Performance of original design SAF basin was satisfactory and height of the basin training walls was sufficient to prevent overtopping. Exit channel was sloped downward and expanded laterally to permit dissipation of excess energy in turbulence rather than direct attack of channel boundaries. A riprap plan of protection was developed for recommended exit channel configuration. (WES) W72-10668

INTERDISCIPLINARY APPROACH TO FLOOD PLAIN PROBLEMS,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 02E.
W72-10718

METHOD OF MAKING ROCKFILL FOUNDATIONS,
Morrison-Knudsen Co., Inc., Boise, Idaho. (as-signee).
For primary bibliographic entry see Field 08E.
W72-10778

DEEP TUNNELS IN HARD ROCK.
Wisconsin Univ., Milwaukee. Coll. of Applied Science and Engineering.
For primary bibliographic entry see Field 05G.
W72-10834

THE FLOODING AND COMBINED SEWER OVERFLOW PROBLEM IN URBAN METRO AREAS,
Wisconsin Univ., Milwaukee. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W72-10835

THE ROLE OF STORAGE IN ECONOMICS OF SEWAGE TREATMENT PLANT DESIGN,
Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 05G.
W72-10837

THE POTENTIAL OF PUMPED STORAGE FOR HYDRO-ELECTRIC GENERATION IN MULTI-LEVEL DEEP TUNNEL SYSTEMS,
Harza Engineering Co., Chicago, Ill.
For primary bibliographic entry see Field 05G.
W72-10839

FREQUENCY SPECTRUM ANALYSIS OF THE OLD RIVER CONTROL STRUCTURE VIBRATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W72-10920

FRP ACID WASTE LINE INSTALLED IN 12 DAYS,
Atlantic Bridge Co. Ltd., Mahone Bay (Nova Scotia).
For primary bibliographic entry see Field 05D.
W72-11041

8B. Hydraulics

STOCHASTIC HYDRAULICS.

Proceedings of 1st International Symposium on Stochastic Hydraulics, Pittsburgh, Penn, May 31-June 2, 1971: University of Pittsburgh School of Engineering, Publications Series No 4, 1971. C. L. Chiu, editor. 769 p. NSF Grant GK-24428.

Descriptors: *Stochastic processes, *Markov processes, *Statistical models, *Mathematical models, *Turbulent flow, Streamflow, Sediment transport, Model studies, Statistics, Statistical methods, Turbulence, Probability.
Identifiers: Random walk models.

This symposium develops the theme that stochastics is a field which can and should be used to assist in the solution to many hydraulic design problems. These problems are in the fields of inland waterway structural design, hydraulic machinery design, and water quality management for large stream and reservoir systems. In hydraulic structure design problems, real deterministic answers are required. As inputs to model studies, as many deterministic values as possible are used including site geometry and water depths, but almost invariably there will also be probabilistic inputs such as probable flow rates, probable temperatures, and probable wave forces. Because river flows, biological activities, and many similar activities are involved in water quality management, stochastic methods are important in this field. While it is virtually impossible to obtain a direct probabilistic solution of system performance in cases where stochastic inputs and persistence factors or time dependence greatly influence the system, it is possible to demonstrate the system performance by computing the deterministic responses of the system for long sequences of stochastic inputs. (See W72-10458 thru W72-10466) (Knapp-USGS) W72-10457

INTRODUCTION TO RANDOM WALK THEORY AND ITS APPLICATION TO OPEN CHANNEL FLOW,

Geological Survey, Washington, D.C.

N. C. Matalas.

In: Stochastic Hydraulics, Proceedings of 1st International Symposium on Stochastic Hydraulics, held at Pittsburgh, Penn, May 31-June 2, 1971: University of Pittsburgh School of Engineering, Publication Series No 4, p 56-65, 1971. 6 ref.

Descriptors: *Stochastic processes, *Markov processes, *Statistical models, *Mathematical models, *Turbulent flow, Streamflow, Sediment transport, Model studies, Statistics, Statistical methods, Turbulence, Probability.
Identifiers: Random walk models.

A random walk is a mathematical formulation of an abstract particle moving from one abstract state to another. For many physical processes, such as those of turbulent motion, these abstractions can be likened to physical phenomena. The abstract particle may represent a sediment particle or a unit of mass or a unit of momentum, and the abstract states may denote coordinate positions within the turbulent field. Though a probability law is assumed to govern the particle's transition from state to state, it may not be necessary to know the magnitudes of the individual transition probabilities. However, if the random walk model is to serve as a basis for simulating the particle's migration over time, then the probabilities must be specified. The stochastic arguments leading to the mathematical model may provide further insight into the nature of the real world process that is being modeled, and the parameters of the stochastic model may have somewhat different interpretations than those of the corresponding deterministic model. As a result, the type of data that is to be collected for model verification may depend upon the conceptual view that is taken of the real world. (See also W72-10457) (Knapp-USGS) W72-10458

A METHOD FOR FLOW COMPUTATION IN FLOOD PLAIN CHANNELS,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
C. L. Yen.

In: Stochastic Hydraulics, Proceedings of 1st International Symposium on Stochastic Hydraulics, held at Pittsburgh, Penn, May 31-June 2, 1971: University of Pittsburgh School of Engineering, Publication Series No 4, p 160-166, 1971. 2 fig, 8 ref.

Descriptors: *Flood plains, *Roughness (Hydraulic), *Stochastic processes, *Statistical models, Mathematical models, Markov processes, Turbulent flow, Sediment transport, Discharge (Water), Streamflow, Statistics, Probability.

Evaluation of resistance coefficients is essential for prediction of discharge in a flood plain channel. The problem involves the deterministic aspect of subdividing the cross-section and the stochastic aspect of determining a roughness indicator. A correction must be made on the hydraulic radius appearing in Chezy's and Manning's formulas in order to accurately evaluate channel resistance. The correction term derives its stochastic nature from a direct association with the variance of velocity fluctuations. Both the correction term and variance of velocity fluctuation can be used as a roughness indicator, which is called effective roughness size. This effective roughness size can be evaluated if the frequency of velocity fluctuations is known. Because no information about the fluctuation frequency is available at the present time, a numerical scheme of least squares fitting was used to evaluate Manning n-values and effective roughness sizes from laboratory data. Based on this analysis and available n-values for rectangular channels having the same boundary materials as the flood plain channels, two new formulas are proposed for main channel and flood plain portions. These formulas compare favorably against methods of equivalent roughness, when applied to laboratory flood plain channels having geometries other than that from which they were derived. (See also W72-10457) (Knapp-USGS) W72-10459

TURBULENT DIFFUSION AND DISPERSION IN OPEN CHANNEL FLOW,

Geological Survey, Fort Collins, Colo.

R. S. McQuivey, and T. N. Keefer.

In: Stochastic Hydraulics, Proceedings of 1st International Symposium on Stochastic Hydraulics, held at Pittsburgh, Penn, May 31-June 2, 1971: University of Pittsburgh School of Engineering, Publication Series No 4, p 231-250, 1971. 9 fig, 2 tab, 5 ref.

Descriptors: *Stochastic processes, *Diffusion, *Dispersion, *Open channel flow, *Hydraulic models, Statistical models, Statistics, Statistical methods, Roughness (Hydraulic), Convection, Turbulence, Turbulent flow, Path of pollutants, Suspended load, Mixing.
Identifiers: Turbulent diffusion.

In streams and rivers turbulent diffusion and dispersion are the principal mechanisms by which liquid and suspended-particle pollutants are dispersed in the flow. A knowledge of the relations between the turbulence characteristics and diffusion and dispersion coefficients is therefore essential in predicting the spread of such contaminants. Longitudinal and lateral turbulent diffusion were studied by measuring the spread of small floating polyethylene particles from a point source on the water surface. Turbulence characteristics were obtained throughout the flow field. Longitudinal dispersion coefficients were obtained from fluorescent dye solution injected into the flow as an instantaneous plane source. The experiments were carried out in a nonrecirculating flume over three boundary roughnesses. The longitudinal and lateral turbulent diffusion coefficients may be evaluated directly from the turbulence characteristics of the flow. A quantitative relation between the Lagrangian and Eulerian time scales was developed from the turbulence measurements and the turbulent diffusion results. The longitudinal diffusion at the surface was 4 to 12 percent of the longitudinal dispersion; this is primarily due to

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differential convection associated with velocity gradients. (See also W72-10457) (Knapp-USGS)
W72-10461

SEDIMENT TRANSPORT-BED LOAD: GENERAL REPORT,

Geological Survey, Fort Collins, Colo.

C. F. Nordin.

In: Stochastic Hydraulics, Proceedings of 1st International Symposium on Stochastic Hydraulics, held at Pittsburgh, Penn., May 31-June 2, 1971; University of Pittsburgh School of Engineering, Publication Series No 4, p 379-391, 1971. 21 ref.

Descriptors: *Bed load, *Sediment transport, *Stochastic processes, *Statistical models, *Mathematical models, Statistics, Statistical methods, Markov processes, Channel morphology, Sand waves, Sedimentary structures, Sedimentation, Alluvial channels.

Identifiers: Stochastic models.

Six papers are discussed in this general review of stochastic processes in sediment transport, presented at the First National Symposium on Stochastic Hydraulics, 1971. They are: (1) A mathematical Model of Bed Transport Caused by River Traffic; (2) Statistically Based Determination of Depth and Width Ratios in Alluvial Watercourses; (3) Stochastic Analysis of Bed Load Transport and Stability of Erodible Bed; (4) The Growth of Sand Waves; (5) A Stationary Gaussian Model of Sand Waves; and (6) A General Stochastic Model for the Transport of Sediment Bed Material. Developments in instrumentation and experimental techniques have been impressive, and these developments have influenced to a large extent the directions of current research. Theoretical development of the mathematical properties of stochastic processes has led to a general and rigorous framework for stochastic models of bed load transport. There is today a widespread acceptance of stochastic models of complex physical processes that previously were treated with limited success as deterministic. Some progress has been made on relating the kinematics of particle motion to the dynamics of the flow. The papers of this session provide excellent examples of activities in all of these areas. (See also W72-10457) (Knapp-USGS)
W72-10462

STATISTICALLY BASED DETERMINATION OF DEPTH AND WIDTH RATIOS IN ALLUVIAL WATERCOURSES,

Florida Univ., Gainesville. Dept. of Civil Engineering.

B. A. Christensen, and P. W. Bush.

In: Stochastic Hydraulics, Proceedings of 1st International Symposium on Stochastic Hydraulics, held at Pittsburgh, Penn., May 31-June 2, 1971; University of Pittsburgh School of Engineering, Publication Series No 4, p 402-425, 1971. 7 fig, 2 tab, 11 ref.

Descriptors: *Bed load, *Sediment transport, *Stochastic processes, *Statistical models, *Mathematical models, Statistics, Statistical methods, Markov processes, Channel morphology, Sand waves, Sedimentary structures, Sedimentation, Alluvial channels.

Identifiers: Stochastic models.

An analytical method, based upon the statistical nature of turbulent flow predicts equilibrium depth of scour (or deposition) due to artificial or natural constrictions (or expansions) in sediment transporting watercourses. The foundation of the method is a bed load formula based on the assumptions that the probability density distribution of the turbulent velocity fluctuations in Gaussian near the bed, that the transported sediment is the same as the bed material, and that this is a cohesionless granular material. The probability of erosion is a function of the time mean bed shear stress. A numerical method solves the resulting equation together with the continuity equation for

water flow to yield equilibrium depth as a function of width of the watercourse, time mean bed shear stress, properties of the uniform or nonuniform bed material, and the hydraulic properties of the bed. A satisfactory agreement between theory and observations is demonstrated in 5 rivers in Florida. (See also W72-10457) (Knapp-USGS)
W72-10463

A STATIONARY GAUSSIAN MODEL OF SAND WAVES,

Geological Survey, Fort Collins, Colo.

C. F. Nordin, Jr.

In: Stochastic Hydraulics, Proceedings of 1st International Symposium on Stochastic Hydraulics, held at Pittsburgh, Penn., May 31-June 2, 1971; University of Pittsburgh School of Engineering, Publication Series No 4, p 472-488, 1971. 8 fig, 1 tab, 17 ref.

Descriptors: *Bed load, *Sediment transport, *Stochastic processes, *Statistical models, *Mathematical models, Statistics, Statistical methods, Markov processes, Channel morphology, Sand waves, Sedimentary structures, Sedimentation, Alluvial channels.

Identifiers: Stochastic models.

For steady, uniform flow conditions, the profile of a streambed, determined by sounding the bed continuously from a fixed point as sand waves migrate under the sounder, can be represented approximately as a continuous stationary Gaussian function of time. The properties are then completely specified by the mean value and the covariance function. The derivatives of the covariance function at the origin or the moments of the spectrum provide a method of describing the sand waves in terms of the width of their spectra. These same parameters determine the probability distributions of the maxima and minima, the distributions of crossings, and other properties of the process. Experimental evidence shows that the spectral band width decreases with increasing particle size of bed material and with decreasing channel width. For fine material, with a relatively wide-band spectrum, the distributions of the maxima can be estimated to determine the magnitude of scour and fill to be expected from the migrating sand waves. Simple models of bedload transport can be derived from the crossing properties of the bed profiles. A dimensionless measure of the spectral width can be used to characterize the bed roughness. The shape of the spectra for high wave-number components is independent of particle size for a range of sizes from 0.2 mm to 1.1 mm. (See also W72-10457) (Knapp-USGS)
W72-10464

EFFECTIVE USE OF STOCHASTIC INFORMATION WITH DETAILED ANALYTIC MODELS,

Texas Water Development Board, Austin.

Systems Engineering Div.

A. O. Weiss, W. L. Meier, and L. R. Beard.

In: Stochastic Hydraulics, Proceedings of 1st International Symposium on Stochastic Hydraulics, held at Pittsburgh, Penn., May 31-June 2, 1971; University of Pittsburgh School of Engineering, Publication Series No 4, p 669-693, 1971. 5 fig, 3 tab, 6 ref.

Descriptors: *Stochastic processes, *Markov processes, *Statistical models, *Mathematical models, *Turbulent flow, Streamflow, Sediment transport, Model studies, Statistics, Statistical methods, Turbulence, Probability.

Identifiers: Random walk models.

Stochastic data, by their very nature, are voluminous and often prohibitive to use in detailed modeling studies because of the tremendous data management and computational burden involved. A methodology is presented which uses the massive volume of stochastic data to obtain only a representative sample of data for use with detailed simulation and optimization models. The sampling methodology is based upon cross-sectioning the

voluminous stochastic data set and subdividing it into selection categories. The selection categories are derived from problem characteristics which best reflect the impact that the stochastic data have on the performance of the system being studied. Both the problem characteristics and the selection categories are used to guide the selection of a representative data sample to be supplied as input to the models. Using the data sampled, the models are used to compute, for evaluation, and expected performance plus a range of system performances that represent those that would have been obtained if the entire stochastic data set had been employed. (See also W72-10457) (Knapp-USGS)
W72-10465

U. S. GEOLOGICAL SURVEY RESEARCH PROGRAM IN STOCHASTIC HYDRAULICS,

Geological Survey, Fort Collins, Colo.

D. R. Dawdy.

In: Stochastic Hydraulics, Proceedings of 1st International Symposium on Stochastic Hydraulics, held at Pittsburgh, Penn., May 31-June 2, 1971; University of Pittsburgh School of Engineering, Publication Series No 4, p 739-743, 1971. 32 ref.

Descriptors: *Stochastic processes, *Markov processes, Research and development, Statistics, Statistical methods, Turbulence, Sediment transport, Geomorphology, Probability, Statistical models.

Identifiers: *U.S. Geological Survey.

The U. S. Geological Survey has an interest in stochastic hydraulics which is expressed across a broad front of research areas. Most of the work is by Survey personnel. Cooperative effort with universities has resulted in thesis research support for several students in areas related to stochastic hydraulics. The transport process for dissolved constituents is a result of the turbulence mechanism. The Geological Survey is particularly interested in the dissolved oxygen relations as indicators of the regenerative capacities of rivers. Historically the Geological Survey has been interested in the study of sediment transport by streams. Much effort has been directed toward the study of the statistical properties of the stream profile itself, in order to relate transport to turbulence, because the boundary itself is deformable, and is both a result of, and a determining factor in, the two interrelated processes. Simultaneously, studies of individual particle movement in sandbed streams have moved toward an understanding of the transport process from a somewhat different direction. The step length, rest period model developed from these papers fits in the general framework of the theory of a random number of random variables. The correlation structure typical of open-channel turbulence processes exhibits the Hurst phenomenon, a topic of great interest at present in hydrology. A so-called 'broken line' process seems to be an excellent model for preserving long-term persistence which does not have many of the limitations imposed by Markovian models. (See also W72-10457) (Knapp-USGS)
W72-10466

DESIGNS FOR RUBBLE-MOUND BREAKWATER, NOYO HARBOR, CALIFORNIA HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

R. A. Jackson.

Available from NTIS, Springfield, Va. 22151. AD-733 849-Price \$3.00 paper copy; 0.95 microfiche. Miscellaneous Paper No 2-841, August 1966. 12 p, 11 photo, 3 plate.

Descriptors: *Breakwaters, *Hydraulic design, *Hydraulic models, *Harbors, *California, Model studies, Waves (Water), Engineering structures, Ocean waves.

Identifiers: *Breakwaters (Rubble-mound), *Noyo Harbor (Calif.).

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A series of model tests was conducted in a wave flume 5 ft wide, 4 ft deep, and 119 ft long using a linear scale of 1:61.4 to determine the stability of a proposed rubble-mound breakwater with cover layers composed of tetrapod armor units. The stability of the breakwater sections, as a function of wave height, was observed visually; and the heights of waves on the harborside of the test sections, generated by wave overtopping and wave energy that was transmitted through voids in the upper portion of the breakwaters, were measured by an electrical wave gage and oscillograph assembly. All of the breakwater sections tested would be stable for the selected design wave 29 ft in height. The stability of the proposed design would be improved if the seaside slope was made flatter than 1:3. Wave heights behind the proposed breakwaters caused by wave overtopping, and wave energy that is transmitted through the voids in the breakwater, are not considered significant relative to the size of waves that would enter the harbor through the navigation opening during storms. (Woodard-USGS)
W72-10469

COOLING WATER DENSITY WEDGES IN STREAMS,
Vanderbilt Univ., Nashville, Tenn. Dept. of Sanitary and Water Resources Engineering.
For primary bibliographic entry see Field 05B.
W72-10566

RISKS ANALYSIS IN DESIGN OF HYDRAULIC PROJECTS,
Illinois Univ., Urbana. Dept. of Civil Engineering.
B. C. Yen, and A. H.-S. Ang.
In: Stochastic Hydraulics, Proceedings of 1st International Symposium on Stochastic Hydraulics, held at Pittsburgh, Penn., May 31 - June 2, 1971: University of Pittsburgh School of Engineering Publication Series No. 4, p 694-709, 1971. 8 fig, 1 tab, 7 ref. OWRR B-043-ILL (3).

Descriptors: *Probability, *Risks, *Design, Hydraulic design, Design criteria, Design standards, Design flood, Reliability, Safety factors, Statistics, Statistical methods, Stochastic processes.
Identifiers: Risk analysis.

In engineering design of hydraulic projects it is often necessary to make use of statistical data. Two types of uncertainties are involved in the design; namely, the objective and subjective uncertainties. Traditionally, in hydraulic projects the reliability of the project as a system is not estimated due mainly to the difficulty in estimating the subjective uncertainties. A new approach for reliability design of hydraulic projects is proposed, based on the probabilistic reliability theory, which has been used extensively in structural and systems analyses, with appropriate extension and modification. The total acceptable project risk is subdivided among the project components for design purposes. The risks associated with the subjective and objective uncertainties are handled separately. The design of a storm sewer is used as an example. Alternatively, the proposed approach can be used to estimate the project reliability implied in conventional design procedures and provides a scientific basis for evaluating the proper safety factor required. (See also W72-10457) (Knapp-USGS)
W72-10639

STEADY-STATE WELL-FLOW THEORY FOR A HORIZONTAL CONFINED AQUIFER WITH ARBITRARY CONDITIONS ON THE OUTER BOUNDARY,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 02F.
W72-10647

HORIZONTAL WATER WELLS (GORIZONTAL'NYYE VODOZABORNNYYE SKVAZHINY),
For primary bibliographic entry see Field 08A.

W72-10656

STREAM-CHANNEL BEHAVIOR AND HYDRAULIC ENGINEERING (DEFORMATII RECHNYKH RUSEL I GIDROTEKHNIKESKOYE STROITEL'STVO),
I. V. Popov.
Gidrometeoizdat, Leningrad, 1969. 364 p.

Descriptors: *Channels, *Channel morphology, *Channel erosion, *Hydraulic engineering, Hydraulic design, Hydraulic structures, Hydroelectric plants, Reservoirs, Streams, Flood plains, Beds, Banks, Rivers, Meanders, Islands, Alluvium, Sediments, Sedimentation, Planning, Mapping.
Identifiers: *USSR, Channel morphometry, Channel patterns, Tectonics.

This three-part monograph, a revision of the original edition published in 1965, presents a new hydromorphological theory of channel regime based on channel patterns and river-bed and floodplain alterations. Methods of calculating morphologic properties, including computations of maximum depths of channel scour and lateral channel shifts, are examined together with recommendations for locating new hydraulic structures. The methods described will provide hydrologists, planners, and researchers with a theoretical and practical approach to problems of channel behavior and hydraulic design. (Josephson-USGS)
W72-10661

PROTOTYPE OBSERVATIONS OF SNETTISHAM PROJECT DIVERSION TUNNEL, LONG LAKE, ALASKA,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

T. E. Munsey, and F. M. Neilson.

Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Miscellaneous Paper H-71-7, April 1971. 13 p, 2 tab, 4 photo, 5 pl.

Descriptors: *Lakes, *Diversion tunnels, *Prototype tests, *Diversion, *Drawdown flow, Roughness (Hydraulics).

Identifiers: Snettisham Project, Lake piercing, Long Lake, *Unlined tunnels.

Report is concerned with unlined diversion tunnel that was used to draw down Long Lake to expose the proposed location for an unlined power tunnel to be constructed as part of the Snettisham project about 28 miles southeast of Juneau, Alaska. The object of the study was to compile project data pertaining to diversion tunnel geometry, lake tapping flow characteristics, and the resultant lake drawdown. These data will augment currently available information concerning the hydraulic characteristics of unlined rock tunnels and lake tapping in the United States. Although lake tapping or piercing for the purpose of establishing a tunnel intake has been a relatively common operation in Norway, it is an unusual operation in the United States. Data pertaining to the hydraulic roughness and friction factor for flow through the diversion tunnel are presented and compared with current design practice. General observations of the lake piercing operation, including a sequence of photographs that depict the front of the initial surge from the tunnel, are also presented. It is concluded that lake tapping proved to be a satisfactory means of diversion at the Snettisham project. (WES)
W72-10665

EVALUATION OF THREE ENERGY DISSIPATORS FOR STORM-DRAIN OUTLETS; HYDRAULIC LABORATORY INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 08A.
W72-10666

DESIGN OF PROPOSED CRESCENT CITY HARBOR, CALIFORNIA, TSUNAMI MODEL; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

P. K. Senter.

Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report H-71-2, February 1971. 33 p.

Descriptors: *Barriers, *Hydraulic models, *Tsunamis, *Harbors, Flood protection.

Identifiers: *Crescent City Harbor, California, *Harbor protection.

Tests were conducted in a 2-ft-wide flume to aid in designing a three-dimensional tsunami model of Crescent City Harbor, Calif. The model will be used to investigate technical feasibility of levee-type barrier to protect the city from attack by tsunamis. Investigation was conducted to determine (a) how runup of tsunami waves is affected by model-scale distortion and change in wave period and (b) an approximate crown elevation needed to prevent all but minor overtopping of the tsunami barrier. Test results showed that a distortion ratio of three could be used in construction of the three-dimensional tsunami model. The two-dimensional tests indicated that a barrier crown elevation of +22 ft mlw would not be overtopped by the design wave. This height, which was selected from two-dimensional flume tests for preliminary design purposes, cannot be considered final until similar tests are conducted in a three-dimensional tsunami model. Design features of a three-dimensional model to study tsunamis at Crescent City Harbor, Calif., are presented. Selected linear scales are 1:125 vertical and 1:375 horizontal, and the model will reproduce approximately 19.2 square miles in the prototype. (WES)
W72-10667

OUTLET WORKS FOR BRANCHED OAK AND COTTONWOOD SPRINGS DAMS, OAK CREEK, NEBRASKA, AND COTTONWOOD SPRINGS CREEK, SOUTH DAKOTA: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08A.
W72-10668

PROPOSED JETTY-HEAD REPAIR SECTIONS, HUMBOLDT BAY, CALIFORNIA: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

D. D. Davidson.

Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report H-71-8, November 1971. 33 p, 48 photo, 26 pl, 2 app.

Descriptors: *Hydraulic models, *Jetties, Repairing, Breakwaters, *Harbors.
Identifiers: *Humboldt Bay, Calif., Armor Units, *Jetty-heads, *Jetty protection.

Tests were conducted to determine information from which economical and stable repair sections can be designed to stop deterioration caused by wave action of seaward ends of north and south jetties at Humboldt Bay. Study included investigation of waves that can attack proposed structure, effects on stability of linking armor units, and optimum shape of armor unit and repair section that would be stable for selected design-wave conditions. Conclusions of study were that (a) 40- and 31-ft design waves were selected for north jetty at still-water levels of +7 and 0.0 ft mlw, respectively; (b) for similar repair sections and armor units, use of a linking medium will increase stability of repair section relative to that obtained with unlinked armor units; (c) a 44-ton tribar section was considered optimum linked repair section for rehabilitation of jetty head; (d) optimum unlinked tribar repair section consists of 65-ton tribars; and (e) it is believed that repair section with minimum

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armor toe distance of 215 ft from radius point of monolith and 43-ton dolos armor units made of 160-pcf concrete, would provide a satisfactory and lasting design. (WES) W72-10669

WAVE TRANSMISSION AND MOORING FORCE TESTS OF FLOATING BREAKWATER, OAK HARBOR, WASHINGTON; HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

D. D. Davidson.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report H-71-3, April 1971. 17 p, 4 tab, 10 photo, 15 pl.

Descriptors: *Breakwaters, *Hydraulic models, *Waves (Water), *Harbors.

Identifiers: *Floating breakwaters, *Mooring, *Oak Harbor, Wash., *Harbor protection.

Tests were conducted on a 1:10-scale model of a twin-pontoon floating breakwater. Chain- and pile-type mooring systems were tested in conjunction with the proposed floating breakwater to determine: effectiveness of proposed structure in reducing existing wave heights; mooring forces for both chain- and pile-type mooring systems; whether proposed breakwater and mooring system would oscillate in resonance with existing wave conditions; and natural period of oscillation of proposed breakwater, while unrestrained in still water. Results indicated that: breakwater proposed by Seattle District will effectively reduce to 0.5 ft incident waves as high as 2.0 ft and 2.5 sec in period; effectiveness of proposed breakwater in attenuating wave action is more a function of wave period than of water depth for both anchor systems tested; a consistently better wave attenuation performance of one mooring system over the other was not evident; mooring forces using chain mooring system were significantly less than those using pile mooring system; no resonant condition of oscillation was noted when using the chain mooring system; the natural period of oscillation of proposed breakwater module was found to be 7.1 sec. (prototype). (WES) W72-10670

THE LIMIT OF APPLICABILITY OF LINEAR WAVE REFRACTION THEORY IN A CONVERGENCE ZONE,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

R. W. Whalin.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Research Report H-71-3, December 1971. 66 p, 92 fig.

Descriptors: *Refraction (Water waves), *Waves (Water), *Model studies, *Coastal structures.

Identifiers: *Linear wave refraction theory, Submarine topography, Wave propagation.

Three wave periods were tested along with three wave heights for each period. All tests were conducted for nonbreaking waves. Data were obtained at 100 locations within the model basin for each condition tested. Basic computation performed was to calculate potential energy transmitted per unit width over one wave period. Experimental data indicated an amplitude attenuation of less than 5 percent due to the combined effects of reflection and bottom friction. Linear refraction theory indicated that cusped caustics should occur on either side of centerline of the tank for each wave period. Nonlinear transfer of energy from lower to higher frequency components during propagation over topography in test basin was investigated by carrying out a harmonic analysis of wave form over one wave period. Nonlinear effects increased as period increased and as wave height increased (for a given wave period). For smallest period tested, nonlinear effects were negligible; in case of the largest wave period and largest wave height, only 20 percent of the energy

remained in fundamental frequency component at end of measurement area. Higher frequency components ranged from being completely coupled to fundamental frequency (for 1-sec wave) to almost completely uncoupled (for 3-sec waves). (WES) W72-10672

MEAN AND TURBULENT VELOCITIES FOR PLANE JET,

Washington State Univ., Pullman. Dept. of Civil Engineering.

W. C. Mih, and J. A. Hoopes.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 98, No HY7, Paper 9050, p 1275-1294, July 1972. 14 fig, 15 ref, append.

Descriptors: *Jets, *Turbulence, *Turbulent flow, *Vortices, Laboratory tests, Hydraulic models, Mixing, Diffusion, Velocity, Statistics, Reynolds number.

Identifiers: Magnetohydrodynamics.

Expressions for the lateral mean velocity, stream function, mean vorticity, and Reynolds stress in the zone of established flow of a two-dimensional jet are based on a Gaussian, axial, mean velocity distribution. Mean and turbulent velocity in a water jet were measured using Pitot tube and MHD (Magnetohydrodynamic) probes. The mean and turbulent velocity distributions are the same for air and water jets at the same Reynolds number and relative location. Turbulence measurements, using the MHD method, yield the correct velocity distribution, but the magnitudes must be corrected for the effects of current density terms. The autocorrelation and spectral density functions exhibit two regions of differing character, corresponding to macro and micro turbulent, eddy scales. The macro-length scale increases linearly and the microscale increases in a nonlinear manner with distance from the slot discharge. (Knapp-USGS) W72-10720

LAGRANGIAN CHARACTERISTICS OF SURFACE TURBULENCE,

Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.

E. Hansen.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 98, No HY7, Paper 9008, p 1255-1273, July 1972. 10 fig, 2 tab, 17 ref, append.

Descriptors: *Turbulence, *Time series analysis, *Dispersion, Statistical methods, Photography, Laboratory tests, Hydraulic models, Mixing, Correlation analysis.

Identifiers: *Lagrangian functions.

While tracing small particles floating at the surface of a steady, uniform, open channel flow, measurements were obtained of the Lagrangian characteristic of surface turbulence. The particles were photographed using a stroboscope as a light source. In this way the changing velocity of a particle was observed as it moves along its path line. The width to depth ratio of the flow considered was large so that dispersion was due exclusively to diffusion caused by surface turbulence. Mean square values, time scales, covariance functions, and variance spectra of the Lagrangian velocity fluctuations were obtained. The estimated Lagrangian covariance functions can be very closely approximated by exponential functions. (Knapp-USGS) W72-10721

SEDIMENT CONTROL METHODS: B. STREAM CHANNELS.

American Society of Civil Engineers, New York. Hydraulics Div.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 98, No HY7, Paper 9071, p 1295-1326, July 1972. 15 fig, 58 ref.

Descriptors: *Sediment control, *Sediment transport, *Sedimentation, *Erosion, Sediments, Streams, Channel erosion, Alluvial channels, Sediment load, Sediment yield.

General knowledge of control of erodible stream channels based on experience is summarized. Natural and artificial erodible channels are classified, the types of problems encountered in their control are described and solutions are outlined. The problems are reviewed in terms of principles, and solutions which have been successful are described and explained in terms of principles. (Knapp-USGS) W72-10722

BOUNDARY LAYER EFFECTS ON HYDRAULIC JUMP LOCATION,

Surrey Univ., Guildford (England). Dept. of Mechanical Engineering.

E. H. Wilson, and A. A. Turner.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 98, No HY7, Paper 9007, p 1127-1142, July 1972. 8 fig, 8 ref, append.

Descriptors: *Hydraulic jump, *Roughness (Hydraulic), *Boundary layers, Laminar flow, Froude number, Reynolds number, Transition flow, Turbulent flow, Critical flow.

The rate of displacement of the toe of a hydraulic jump along a channel with respect to change in tailwater elevation is defined as the position sensitivity of the jump. The steady flow downstream of a model sluice gate was analyzed theoretically for the case of a laminar boundary layer developing from the vena contracta and breaking into fully developed turbulent flow. The position sensitivity of the jump is dependent upon Froude number, boundary roughness and distance downstream from the gate. Experiments were performed using a shallow stream 4.064 mm deep. The theoretical analysis is justified. The jump is much more sensitive in a laminar boundary layer development region than in a fully developed turbulent flow. In general, sensitivity is greater in laminar than turbulent flow, is decreased by an increase in boundary roughness, and by an increase in Froude number. Because model tests are at a lower Reynolds number than corresponding full scale situations, model results for jump sensitivity are conservative. (Knapp-USGS) W72-10725

A STUDY OF THE MIXING OF HEAT STRATIFIED FLOW UNDER VARYING TURBULENCE CONDITIONS WITH APPLICATION TO THE REDUCTION OF RIVER HEAT POLLUTION,

Connecticut Univ., Storrs.
For primary bibliographic entry see Field 05B. W72-10833

THE INFLUENCE OF SURFACE ROUGHNESS FLOW-THROUGH DUCTS ON THE HYDRAULIC EFFICIENCY OF CENTRIFUGAL PUMP STAGES,

Sh. R. Ageyev.
Trans. available from NTIS, Springfield, Va 22151 as AD-734 861 Price: \$3.00 paper copy; \$0.95 microfiche. Air Force Systems Command Foreign Technology Division Machine Translation Report FTD-MT-24-1459-71, October 1971. 11 p, 2 fig, 2 tab, 10 ref. Originally published in Energomashinstrojeniye (Power Equipment Manufacture), No 3, p 19-21, 1971.

Descriptors: *Flow characteristics, *Flow friction, *Ducts, *Pumps, *Hydraulic conduits, Testing, Hydraulics, Hydraulic structures, Flow resistance, Research equipment.

Identifiers: Centrifugal pump stages, Surface roughness, Flow-through ducts.

The influence of the surface roughness of flow-through ducts on the hydraulic efficiency of centrifugal pump stages is described. Three different

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series of stages are broken down in detail. The experimental part consisted of conducting normal and balance stages tests on a laboratory stand. The stages (impellers and bends) were manufactured from cast iron with green sand casting. The different roughness of the cast surfaces of stages occurred because of the use of mold cores manufactured from molding sand of different granular composition. In one of the modifications of every series of stages the surfaces of the flow-through ducts were cleaned and coated with three layers of varnish GF-95. (Woodard-USGS)
W72-10903

ROLE OF SUBSURFACE FLOW IN GENERATING SURFACE RUNOFF: I. BASE FLOW CONTRIBUTIONS TO CHANNEL FLOW,
Thomas J. Watson Research Center, Yorktown Heights, N.Y.
For primary bibliographic entry see Field 02A.
W72-10905

FREQUENCY SPECTRUM ANALYSIS OF THE OLD RIVER CONTROL STRUCTURE VIBRATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
R. A. Yates.

Available from NTIS, Springfield, Va. 22151 as AD-734 096-Price \$3.00 paper copy; \$0.95 microfiche. Miscellaneous Paper No 2-774, December 1965. 12 p., 2 fig, 6 plate.

Descriptors: *Waves (Water), *Engineering structures, *Vibrations, *Spectrometers, *Prototype tests, Analytical techniques, Hydrologic data, Instrumentation, Louisiana.
Identifiers: *Old River (Miss), River control structure, Vibration frequencies, Structure displacements, Accelerometers.

The wave spectrum analysis of the Old River (Mississippi) Control Structure vibration is summarized. Data from a number of accelerometers were analyzed over the frequency ranges of 0.25 to 4 cps and 4 to 14 cps. Structural displacements were calculated from these data. Statham Types A69TC 5g and 5g-A3 accelerometers were used in the experiments. The operations of the wave analyzer in obtaining the amplitude spectral density are described. (Woodard-USGS)
W72-10920

OUTLET WEIRS FOR TRAPEZOIDAL GRIT CHAMBERS,
Indian Inst. of Science, Bangalore.
For primary bibliographic entry see Field 05D.
W72-11054

AN EVALUATION OF CHEMICAL GAUGING TECHNIQUES,
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 02E.
W72-11068

8C. Hydraulic Machinery

FINAL REPORT: AUTOMATIC DOWNSTREAM CONTROL SYSTEMS FOR IRRIGATION CANALS,
California Univ., Berkeley. Hydraulic Engineering Lab.
M. J. Shand.

Available from the National Technical Information Service as PB-203 672, \$3.00 in paper copy, \$0.95 in microfiche. Report HEL-8-4, August 1971. 159 p., 12 tab., 43 fig., 13 ref.

Descriptors: *Irrigation canals, *Computer programs, Hydraulics, *Control systems, *Automatic control, Open channel flow, Unsteady flow, Water levels, Flow profiles, Check structures,

Gates, Discharge coefficients, Gate control, Downstream, Analog model, Model studies, Numerical analysis, Equations.

Irrigation canals could successfully be operated by automatic downstream control systems where the offset of downstream water level in a canal reach determines the upstream gate opening. A deterministic generalized mathematical model (finite-difference form of partial differential equations) as a FORTRAN-language computer program is developed for a canal reach with downstream control. Model parameters are determined for two controllers: HyFLO hydraulic filter and Smith linear predictor. Numerical models indicate that regulation is satisfactory with both controllers. Smith controller provides improved performance and is an alternative to computer-operated remote control. (Popkin-Arizona)
W72-10526

GEOOTHERMAL RESOURCES IN CALIFORNIA—POTENTIALS AND PROBLEMS,
California Inst. of Tech., Pasadena. Environmental Quality Lab.
For primary bibliographic entry see Field 06G.
W72-10550

OPERATING FORCES ON SECTOR GATES UNDER REVERSE HEADS; APPENDIX A: RESULTS OF SUPPLEMENTAL TESTS; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
N. R. Oswalt, and T. E. Murphy.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report H-70-2, Appendix A, December 1971. 4 p., 3 tab., 6 pl.

Descriptors: *Hydraulic models, *Gates, *Locks, *Control structures.
Identifiers: *Sector gates, *Operating forces, Reverse head (Fluid mechanics), Vermilion Lock.

In revisions made to the improved sector gate in the basic report the curved horizontal girders were placed in back of the skin-plate ribs, and the timber fenders were extended to within 8 in. of the full radius of the gate. One leaf of the model of the improved sector gate was modified to reproduce the Vermilion gate at the nose of the gate leaf. This gate leaf was tested at a scale of 1:20 in the facilities and by procedures described in basic report. Results of tests demonstrated that the major loads on the gate are caused by members in the immediate vicinity of the skin plate at the miter noses of the gate leaves. Addition of the 8- by 4- by 1/2-in. angle that blocked side flow at the miter edge of the skin plate was the primary reason for forces on gate tested in this series being several times greater than those observed with the improved sector gate in basic report. The timber bumper fenders, which are offset from the skin plate, had a negligible effect on forces. (WES)
W72-10671

SALT WATER DISTILLATION AND CONDENSATION SYSTEM AND METHOD,
For primary bibliographic entry see Field 03A.
W72-10774

DEEP TUNNELS IN HARD ROCK.
Wisconsin Univ., Milwaukee. Coll. of Applied Science and Engineering.
For primary bibliographic entry see Field 05G.
W72-10834

THE POTENTIAL OF PUMPED STORAGE FOR HYDRO-ELECTRIC GENERATION IN MULTI-LEVEL DEEP TUNNEL SYSTEMS,
Harza Engineering Co., Chicago, Ill.
For primary bibliographic entry see Field 05G.
W72-10839

8D. Soil Mechanics

ENGINEERING METHODS OF CALCULATING AND FORECASTING WATER EROSION (INZ-HENERNNYE METODY RASCHETA I PROGNOZA VODNOY EROZII),
For primary bibliographic entry see Field 02J.
W72-10655

8E. Rock Mechanics and Geology

METHOD OF MAKING ROCKFILL FOUNDATIONS,
Morrison-Knudsen Co., Inc., Boise, Idaho. (assignee).

J. P. Frein, and A. Casagrande.
U. S. Patent No. 3,526,096, 3 p., 9 fig., 3 ref.; Official Gazette of the United States Patent Office, Vol. 878, No. 1, p. 33, September 1, 1970.

Descriptors: *Patents, *Engineering structures, *Bridge construction, *Foundations.
Identifiers: Rockfill foundations.

This invention extends the range of operations possible in deep and hazardous waters for bridge pier construction. The lower portion of the foundation is made from large size, hard durable rock. The upper portion is formed from individually compacted rock layers rising to within a desired range of water surface. A surcharge of rock approximately equal to the expected load is added to the compacted layer. Surcharged rock is used to form a breakwater around the work area for construction of a weight distributor block on the upper surface of the compacted layers. (Sinha-OEIS)
W72-10778

DEEP TUNNELS IN HARD ROCK.
Wisconsin Univ., Milwaukee. Coll. of Applied Science and Engineering.
For primary bibliographic entry see Field 05G.
W72-10834

GEOLOGIC EXPLORATION FOR CHICAGO LAND AND OTHER DEEP ROCK TUNNELS TO BE CONSTRUCTED BY MECHANICAL MOLES,
Dames and Moore, Park Ridge, Ill.
For primary bibliographic entry see Field 05G.
W72-10843

8G. Materials

CORROSION OF WELL-CASING AND SCREEN METALS IN WATER FROM THE MAGOTHY AQUIFER AND IN INJECTED RECLAIMED WATER, BAY PARK, LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
For primary bibliographic entry see Field 05B.
W72-10737

8H. Rapid Excavation

DEEP TUNNELS IN HARD ROCK.
Wisconsin Univ., Milwaukee. Coll. of Applied Science and Engineering.
For primary bibliographic entry see Field 05G.
W72-10834

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO EXPERIENCES AND FUTURE PLANS FOR HARD ROCK TUNNELS,
Metropolitan Sanitary District of Greater Chicago, Ill.
For primary bibliographic entry see Field 05G.
W72-10836

EUROPEAN DEVELOPMENT AND EXPERIENCE WITH MECHANICAL MOLES IN HARD ROCK TUNNELING,
Atlas Copco A.B., Stockholm (Sweden).
For primary bibliographic entry see Field 05G.
W72-10840

EUROPEAN DEVELOPMENT AND EXPERIENCE WITH MECHANICAL MOLES IN HARD ROCK TUNNELING,
Demag A.G., Duisburg (West Germany).
For primary bibliographic entry see Field 05G.
W72-10841

EXPERIENCE IN EDMONTON CANADA WITH EMPHASIS ON PNEUMATIC CONVEYANCE OF MUCK,
Edmonton Water and Sanitation Dept. (Alberta).
For primary bibliographic entry see Field 05G.
W72-10842

GEOLIC EXPLORATION FOR CHICAGO LAND AND OTHER DEEP ROCK TUNNELS TO BE CONSTRUCTED BY MECHANICAL MOLES,
Dames and Moore, Park Ridge, Ill.
For primary bibliographic entry see Field 05G.
W72-10843

THE CONTRACTORS VIEWPOINT OF THE HARD ROCK MECHANICAL MOLE—WHAT'S CAUSING DOWNTIME. WHAT DO THEY WANT.
Mining Consultant, Salt Lake City, Utah.
For primary bibliographic entry see Field 05G.
W72-10844

RAPID EXCAVATION IN HARD ROCK: A STATE-OF-THE-ART REPORT.
Bureau of Mines, Minneapolis, Minn. Twin Cities Mining Research Center.
For primary bibliographic entry see Field 05G.
W72-10845

81. Fisheries Engineering

MODELLING THE EFFECT OF THE FOOD BASE ON THE DYNAMICS OF A FISH POPULATION,
V. V. Menshutkin, and Yu. Ya. Kislyakov.
Trans. available from NTIS, Springfield, Va. 22151. as PB-203 801-T-Price \$3.00 paper copy; \$0.95 microfiche. Trans. from Zoologicheskii Zhurnal, Vol 47, No 3, p 325-330, 1968. Bureau of Sport Fisheries and Wildlife, Translation, July 1971. 8 p.

Descriptors: *Fish populations, *Fish food organisms, *Fish diets, *Computer models, *Commercial fish, Analytical techniques, Input-output analysis, Commercial fishing.
Identifiers: Food base (Fish).

A commercial fish population is examined as a complex cybernetic system. The effect of the food base on a population as a single complete object possessing a complex structure is processed on a digital computer model. The size of the food base changing with time is fed into the input of the system and the catch for 50 years is traced. Two rules of change of the food base are examined: sinusoidal and chance with normal distribution. Not every fluctuation of the food base will be repeated in change in the biomass of a commercial fish population and not every periodic fluctuation of catches of a commercial fish is necessarily connected with variations of the food base. (Woodard-USGS)
W72-10629

POND CULTURE OF BAIT FISHES,
Colorado Cooperative Fishery Unit, Fort Collins.
For primary bibliographic entry see Field 02H.

W72-10696

REARING SINGLE AND MULTIPLE SPECIES POPULATIONS OF CATFISHES IN CAGES,
State Coll. of Arkansas, Conway.

R. A. Collins.

Available from the National Technical Information Service as COM-72 10046, \$3.00 in paper copy, \$0.95 in microfiche. Completion report Aug 1970, 14 p, 2 fig, 2 tab. NMFS-4-49-R.

Descriptors: *Aquaculture, *Catfishes, Freshwater fishes, Diets, Animal growth, Fish farming.

Triplicate experiments of single species and mixed species of channel and blue catfish in cages yielded the following results: Channel catfish consistently grew more rapidly than blue catfish stocked together or separately. Channel catfish fed twice a day showed an additional increase in growth over blue catfish fed twice daily. There was no significant difference between growth rates or conversion rates between single populations and mixed populations.
W72-10698

DEVELOPMENT OF THE CAGE CULTURE METHOD OF FISH PRODUCTION FOR COMMERCIAL USE IN LARGE RESERVOIR LAKES,

State Coll. of Arkansas, Conway.

For primary bibliographic entry see Field 02H.

W72-10699

CLUPIIDS IN THE ALTAMAHIA RIVER, GEORGIA,

Georgia Game and Fish Commission, Brunswick. Coastal Fisheries Div.

For primary bibliographic entry see Field 02E.

W72-10700

LIFE HISTORY AND ECOLOGY OF CARP, CYPRINUS CARPIO LINNAEUS, IN ELEPHANT BUTTE LAKE, NEW MEXICO,
New Mexico State Univ.

For primary bibliographic entry see Field 02H.

W72-10701

EFFECTS OF COMMERCIAL FISHING ON THE POPULATION OF SMALLMOUTH BUFFALO, ICTIOPUS BUBALUS (RAFINESQUE), IN ELEPHANT BUTTE LAKE, NEW MEXICO,
New Mexico State Univ.

For primary bibliographic entry see Field 02H.

W72-10702

CLAM SHELL PLANTING FOR OYSTER CULTCH,

Louisiana Wild Life and Fisheries Commission, New Orleans.

For primary bibliographic entry see Field 02L.

W72-10704

CULTURING TROUT IN CAGES,

State Coll. of Arkansas, Conway.

R. A. Collins.

Available from the National Technical Information Service as COM-72 10055, \$3.00 in paper copy, \$0.95 in microfiche. Completion report, Sep 1971, 14 p, 1 fig, 4 tab. NMFS-2-133-R.

Descriptors: *Aquaculture, *Trout, Fisheries, Freshwater fishes, Diets, Animal growth, Temperature.

Identifiers: *Cage culture.

The major objectives were to determine the feasibility of culturing rainbow trout in cages from fingerlings to edible size during the cooler months of the year in warmwater lakes, the proper stocking density in the cage, and the economic feasibility of culturing trout in cages. Rainbow trout adapted readily to confinement in cages, where they grew,

converted feed, and survived unusually well during winter conditions in a warmwater lake. Temperatures as low as 3.5°C were tolerated by the trout without a distinct reduction in feed consumption or growth. Temperatures as low as 2°C caused a lag in feed consumption and growth rate. Disease caused no significant problem and survival was 99.35%. The trout swam in a counter clockwise direction at all times except when they were fed. Density as high as 455 fish and 75 kg per cubic meter produced no reduction in rate of growth or feed conversion. The fish converted feed at the ratio of 1.54 to 1. An area around 33°34' deg. latitude and east of the 100th meridian should provide water temperatures most suitable for culture of trout during the winter. Economic considerations indicate a favorable profit potential in some situations for the culture of trout in cages during the winter in warmwater lakes.
W72-10803

A SIMPLE ELECTRICALLY-OPERATED FEEDER FOR USE IN SALMON REARING,
Freshwater Fisheries Lab., Pitlochry (Scotland). J. Minar.

J Fish Biol. Vol 3, No 4, p 413-415, 1971, Illus.

Identifiers: *Feeders, *Salmon, Instrumentation.

The construction of a simple, automatic feeder designed to dispense dry food used in salmon rearing is described. The feeder is powered by a 12 V battery and controlled by 2 electric clocks. Frequency of feeding, the daily duration of the feeding period, and the quantity of food dispensed can be adjusted.—Copyright 1972, Biological Abstracts, Inc.
W72-10827

AN ANNOTATED BIBLIOGRAPHY OF ATTEMPTS TO REAR THE LARVAE OF MARINE FISHES IN THE LABORATORY,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 05C.
W72-10873

DYNAMICS OF FISHES IN AN ALABAMA POND SUBJECT TO INTENSIVE ANGLING,
Bureau of Sport Fisheries and Wildlife, Pierre, S. Dak. North Central Reservoir Investigation.

J. H. Elrod.

Trans Am Fish Soc. Vol 100, No 4, p 757-768.

1971. Illus.

Identifiers: *Alabama, *Angling, Dynamics, *Fishes, Ictalurus catus, Ictalurus punctatus, Lepomis macrochirus, Lepomis microlophus, Micropterus salmoides, Ponds.

Populations of largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), redear sunfish (*L. microlophus*), channel catfish (*Ictalurus punctatus*), and white catfish (*I. catus*) in a 10.3 ha pond were observed for 2 yr following removal of 314 kg/ha the first yr of angling. Estimates of component species population parameters were made from fishing records, seine catches, a mark and recapture study, and a census of the fish recovered when the pond was drained. Fishing pressure ranged between 934 and 1509 angler hr/ha. Catch per angler hr declined from 208 g in 1963 to 137 g in 1965. Catches in the second and third yr of fishing were 145 and 170 kg/ha, respectively. Decreased catches of bluegill, the dominant species in catches, were associated with a reduced growth rate that accompanied a high density of small bluegills. Addition of 25 adult largemouth bass per ha did not reduce abundance of the bluegills. Redear sunfish reproduction was negligible during the 2 yr of high bluegill abundance. First-yr growth of largemouth bass was related to abundance of bluegill fry, and year-class strength of bluegill was associated with abundance of young-of-yr largemouth bass. Channel catfish reproduction was insufficient to sustain a fishable population, and angler return from restocking with fish 115-265 mm total length was low. White cat-

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fish maintained a small stock. Standardized seining appeared to be a reliable method for assessing relative abundance of bluegills and redear sunfish less than 140 mm total length and young-of-yr largemouth bass.—Copyright 1972, Biological Abstracts, Inc. W72-10934

FURTHER OBSERVATIONS ON INDUCED BREEDING OF SILVER CARP AND GRASS CARP DURING 1968,

Central Inland Fisheries Research Inst., Cuttack (India). Fisheries Research Station.

S. B. Singh, K. K. Sukumaran, and P. C.

Chakrabarti.

Proc Natl Acad Sci India Sect B (Biol Sci). Vol 40, No 3, p 88-98. 1970 (1971). Illus.

Identifiers: Breeding, *Carp, Grass carp, India, Silver carp, *Fish reproduction.

Induced breeding experiments on silver carp and grass carp at Cuttack in 1968 yielded 9.01 lakhs (0.901 million) and 4 lakhs (0.4 million) of spawn which is the highest achieved so far. Rearing of breeders of the 2 spp. at low stocking density of 1500 kg/ha and proper feeding of grass carp helped to keep them in good condition. Sufficient accumulation of fresh rain water and intermittent rains and cool weather during the experiment gave encouraging results. Synahorin along with fish pituitary gave positive response in silver carp, but not so in grass carp. Hybrids between female silver carp and male grass carp were produced on a limited scale, for the first time in India, and the offspring are surviving and growing normally.—Copyright 1972, Biological Abstracts, Inc. W72-11009

THE IDENTITY LEVEL OF CHIRONOMID INVENTORY OF CARP PONDS,

Institut fuer Binnenfischerie, Berlin (West Germany).

D. Barthelmes.

Z Fisch Hilfswiss. Vol 18, No 3/4, p 161-177. 1970. English summary.

Identifiers: Carp, *Diptera, Chironomus plumosus, Identity, Inventory, Management, *Ponds.

The chironomids reveal great qualitative differences even in the various zones of the same pond. As the size of the pond increases, the zones and their populations dissociate more and more. Neighboring ponds which are managed in the same way have only 65 to 86% identical chironomid genera. Pond pairs of the pond farms Peitz and Friedrichshamoor which were investigated simultaneously and managed in the same way revealed only 43 to 78% identical chironomid genera. These differences in life structure are one of the reasons for the individuality of carp ponds. However, they hardly increase together with the distance between the ponds, as is demonstrated by Polish, Soviet and Bulgarian ponds. Irrespective of the short-term dynamics of individual dominances, every year similar features are observed in the same pond in case of equal treatment. The dominance as well as the genus-spectrum may be essentially changed by stringent measures of amelioration as well as by changes in management. The percentage of Chironomus plumosus in the total mass of chironomids is generally high in the fattening and growing ponds, while it is low in the hatching ponds. This difference is largely due to management practices. Green plants are populated by chironomid larvae in a similarly varying way as the ponds as a whole.—Copyright 1972, Biological Abstracts, Inc. W72-11013

THE CHANGING QUANTITY OF MACROZOOBENTHOS IN THE CARP POND DURING THE AQUATIC PERIOD,

Institut fuer Binnenfischerie, Berlin (West Germany).

D. Barthelmes.

Z Fisch Hilfswiss. Vol 18, No 3/4, p 179-194. 1970. Illus. English summary.

Identifiers: Benthos, *Biomass, Carp, *Ponds, Quantity, Seasonal.

The benthic biomass exhibits more or less pronounced maxima and minima during the aquatic phase. In ponds that are dry in winter the maxima frequently occur in June or July. However, there are many exceptions. Especially in ponds whose bottoms never dry out completely and the maxima are irregularly distributed over the entire aquatic period and may considerably shift from 1 yr to another. In well drained ponds the maxima seem to occur with greater regularity early in summer. In the hatching ponds which are drained in spring maximum biomasses occur mostly in winter or shortly before spring catching. The change of the biomass quantity is promoted by pond drainage and the resulting reduction of population density. Occasional mass occurrences of poorly competitive or rare species are characteristic of the conditions favorable for population shortly after filling. It seems that the sudden increase of biomass, which is particularly pronounced in ideally drained ponds during the maximum, regularly leads to a considerable overpopulation as related to the carrying capacity of the biotope. This results in an accordingly strong back-regulation to below the balance level in the minimum.—Copyright 1972, Biological Abstracts, Inc. W72-11014

RESULTS AND PROBLEMS OF FISH NUTRITION UNDER CONDITIONS OF INDUSTRIALIZED PRODUCTION: A SURVEY OF SELECTED LITERATURE,

Institut fuer Binnenfischerie, Berlin (West Germany).

W. Steffens.

Z Fisch Hilfswiss. Vol 18 No 3/4, p 195-207. 1970. English summary.

Identifiers: Cyprinus Carpio, *Fish farming, *Fish diets, Nutrition, Salmo gairdneri, Surveys.

A survey is given of the present knowledge in the field of nutrition physiology of fish under industrialized conditions. Special emphasis is laid on carp (*Cyprinus carpio*) and rainbow trout (*Salmo gairdneri*). The following problems are discussed: the importance of dry feedstuffs for intensive fish production; their applicability with various fish species and at various stages of growth; the appropriate composition of the dry feedstuffs with regard to their content of protein, carbohydrates, fat and vitamins; the achievable increment; the feed input; the practical implementation of feeding; and aspects of nutrient economy.—Copyright 1972, Biological Abstracts, Inc. W72-11015

TESTING THE PERFORMANCE AND RESISTANCE OF SAXON CARP STRAINS: A CONTRIBUTION TO THE EVALUATION OF THE BREEDING CAPACITY OF GERMAN POND CARP (*CYPRINUS CARPIO*),

Humboldt-Universität zur Berlin (East Germany).

Institut fuer Fischereiwesen.

L. Nagel.

Z Fisch Hilfswiss. Vol 18, No 3/4, p 217-226. 1970. Illus. English summary.

Identifiers: Breeding, *Carp, Cyprinus carpio, Performance, Ponds, Resistance, Strains, *Fish reproduction, Fish farming.

With the view of increasing the production of healthy, resistant fingerling carps that meet market requirements, the growth performance as well as the resistance to diseases of 5 Saxon pond carp strains and a cross obtained from them were studied. The carps were tested for 3 yr from spawns to marketable size under equal environmental conditions. The tests were performed with a test strain of carp in separate and common ponds. Evaluation of performance tests confirmed that under equal environmental conditions the F1-generation of the various carp strains had almost the same morphological and anatomical properties as the parent generation. There remained only a dif-

ference between the long and broad-headed carp strains and the high-backed and narrow-headed ones. No hybrid effect was established for the body characters of the spiegel-carp cross, due to the far-reaching equality of the 2 parents. In the performance tests the F1-generations of the spiegel-carp strain from Koesslitz which had been obtained by continuous crossing and the spiegel-carp cross of 1962 revealed the highest increase in numbers (115 to 125%) and the lowest losses (56 to 71%), which is probably due to the hybrid effect. However, much higher losses and lower growth performances occurred with the F1-generations of the fully scaled carp strain from Dobra and the genetically old carp strains from Welzeholz and Zeisholz. These high fish losses are primarily due to constitutional weaknesses, such as depression by inbreeding. A genuine performance decline still exists with the tested Saxon breeding stock, which calls for further breeding work and the introduction of commercial crossing on German pond carp.—Copyright 1972, Biological Abstracts, Inc. W72-11020

OBSERVATIONS ON THE BIOLOGY, INDUCED BREEDING AND CULTURAL POSSIBILITIES OF THE CATFISH, OMPOK BIMACULATUS (BLOCH) IN PONDS,

Central Inland Fisheries Inst., Hazaribagh (India).

S. Parameswaran, C. Selvaraj, and S.

Radhakrishnan.

Proc Natl Acad Sci India Sect B (Biol Sci). Vol 40, No 3, p 145-162. 1970 (1971). Illus.

Identifiers: *Biology, Breeding, Carp, *Catfish, Compatibility, Ompok-Bimaculatus, Ponds, Fish reproduction, *Aquiculture, Fish farming.

Studies on the different aspects of the biology of *O. bimaculatus* in confined waters, mainly ponds, were made. Experiments on the breeding by hypophyseal extracts and its growth and productivity in ponds were conducted. Its cultural possibilities as a compatible species in carp ponds are discussed.—Copyright 1972, Biological Abstracts, Inc. W72-11034

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

UNIVERSITY PUBLIC SERVICE PROGRAMS AS THEY RELATE TO WATER RESOURCES MANAGEMENT IN WISCONSIN,

Wisconsin Univ., Madison.

For primary bibliographic entry see Field 06B.

W72-10483

10. SCIENTIFIC AND TECHNICAL INFORMATION

10A. Acquisition AND Processing

THE DEVELOPMENT OF A PROCEDURE FOR ACQUIRING AND DISSEMINATING INFORMATION ON WATER USE, VOLUMES, 1 AND 2.

Enviro Control, Inc., Washington, D.C.

For primary bibliographic entry see Field 07A.

W72-10467

SCIENTIFIC AND TECHNICAL INFORMATION—Field 10

Preparation of Reviews—Group 10F

**10C. Secondary Publication
AND Distribution**

CHROMATE POLLUTION OF WATER - DETECTION, EFFECTS, AND PREVENTION: A BIBLIOGRAPHY.
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 05A.
W72-10684

PHENOL POLLUTION OF WATER: A BIBLIOGRAPHY.
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 05A.
W72-10685

INDEXED BIBLIOGRAPHY ON ENVIRONMENTAL MONITORING FOR RADIOACTIVITY,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 05B.
W72-10689

ADMINISTRATION, SYSTEMS ANALYSIS.
Cornell Univ., Ithaca, N. Y. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 05G.
W72-10779

AN ANNOTATED BIBLIOGRAPHY OF ATTEMPTS TO REAR THE LARVAE OF MARINE FISHES IN THE LABORATORY,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 05C.
W72-10873

RADIOACTIVE WASTE PROCESSING AND DISPOSAL.
Atomic Energy Commission, Oak Ridge, Tenn.
For primary bibliographic entry see Field 05A.
W72-10988

10F. Preparation of Reviews

CONCENTRATION FACTORS IN THE AQUATIC ENVIRONMENT,
New York Univ., Medical Center, N.Y. Inst. of Environmental Medicine.
For primary bibliographic entry see Field 05A.
W72-10472



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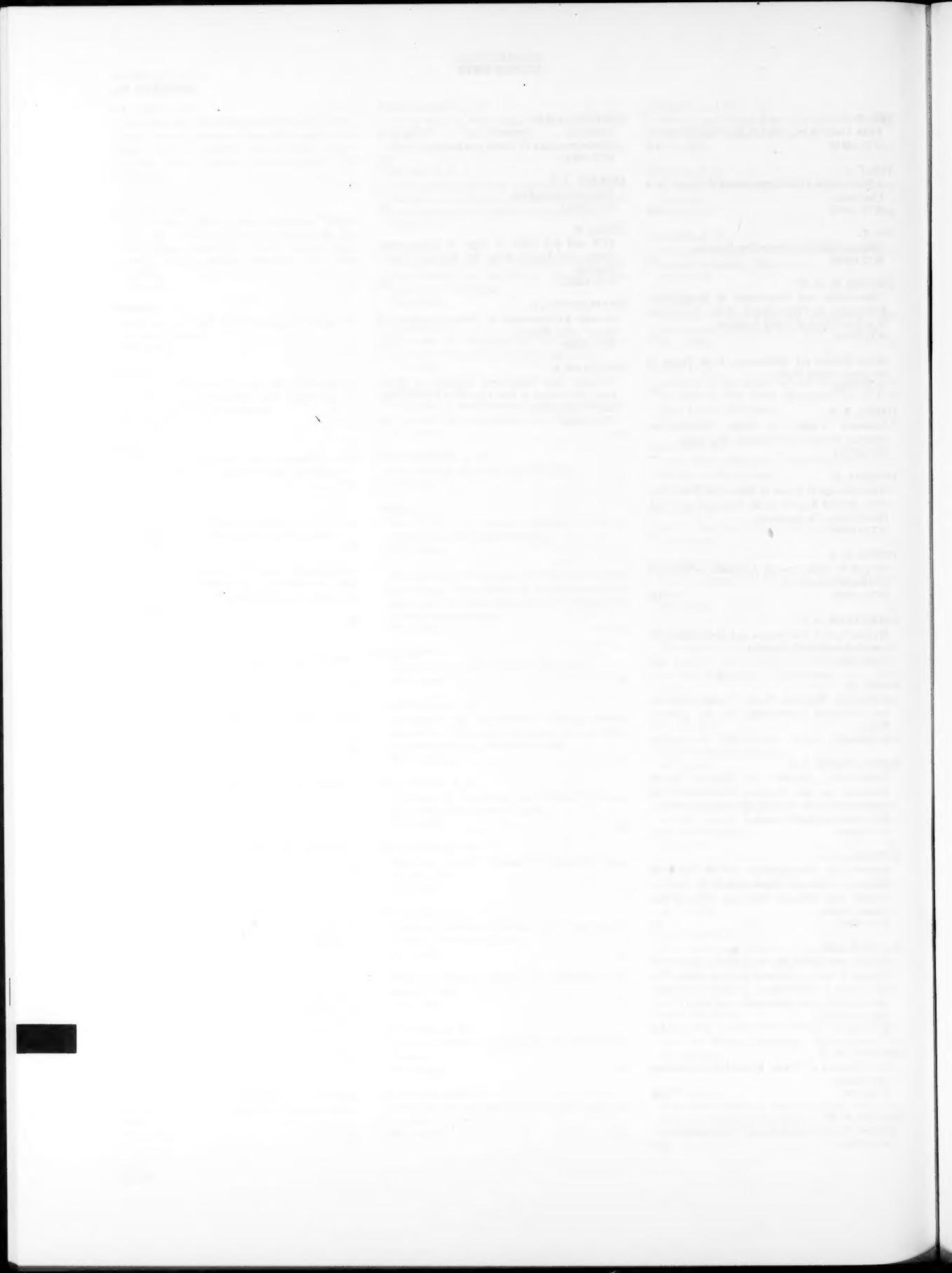
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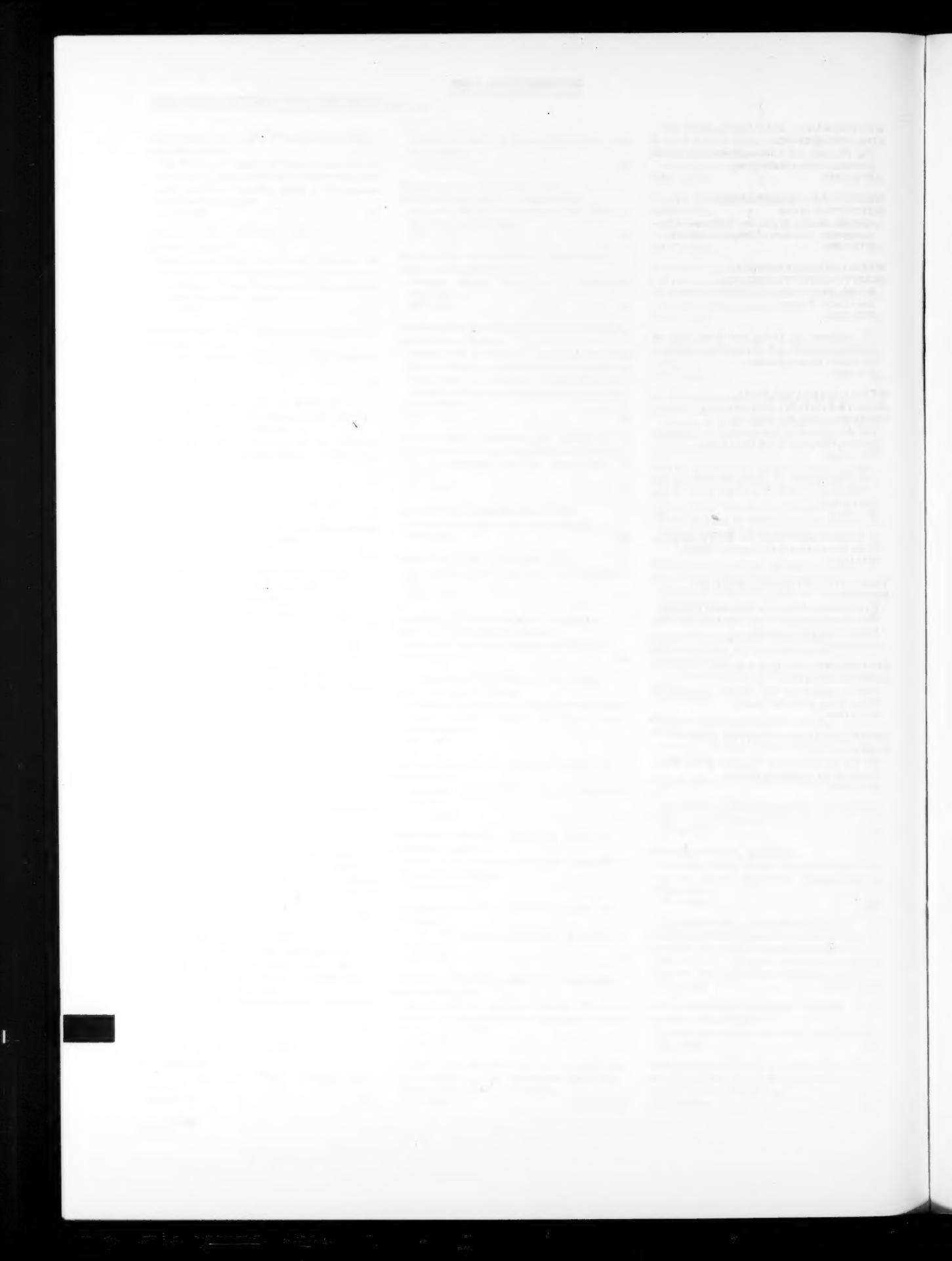
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- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the Soap and Detergent Association and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Public water supply treatment technology at the American Water Works Association.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural livestock wastes at the Department of Agricultural Engineering of Iowa State University.
- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Environmental Protection Agency.
- Coastal pollution at the Oceanic Research Institute.
- Water treatment plant waste pollution control at American Water Works Association.
- Effect on water quality of irrigation return flows, at the Department of Agricultural Engineering of Colorado State University.

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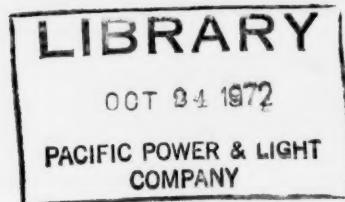
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